
2008 ASHRAE ANNUAL MEETING

SALT LAKE CITY TECHNICAL PROGRAM

SUNDAY, 6/22
8 A.M.–9:30 A.M.

Note: This is not the final program and is subject to change. Updated May 6, 2008



Indicates program is submitted for approval for NY PDHs.



Indicates program is submitted for AIA Learning Units.

Sunday, June 22, 8 a.m. – 9:30 a.m.

Transactions Session 1 (Intermediate)

Current Research Topics on HVAC Duct Acoustics

Track: Fundamentals

Room I

Sponsor: 2.6 Sound and Vibration Control

Chair: Curt Eichelberger, P.E., Member, Johnson Controls, York, PA

This session presents the results of two research projects, sponsored by TC2.6 on duct acoustics. RP1314 is an experimental investigation of the duct end-reflection loss at low frequencies. RP1219 is an experimental investigation of duct rumble noise in air distribution systems. Results from both of these projects will be helpful to design professionals who are concerned with sound generation and propagation in HVAC ducts.

1. Experimental Investigation of Reflection of Airborne Noise at Duct Terminations (RP-1314) (SL-08-001)

Kenneth Cunefaer, Ph.D., Member, Georgia Institute of Technology, Atlanta, GA; Alexander P. Michaud, Ph.D., Cerami & Associates, Inc., New York, NY

2. Qualification of Fan Generated Duct Rumble Noise, Part 1: Test Facility (RP 1219) (SL-08-002)

Joshua Kading, Member, Stanley Consultants, Inc, Muscatine, IA; J. Addin Mann III, Ph.D., Member, Michael B. Pate, Ph.D., Member, Iowa State University, Ames, IA

3. Qualification of Fan Generated Duct Rumble Noise, Part 2: Results (RP 1219) (SL-08-003)

Adin Mann, Ph.D., Member, Iowa State University, Ames, IA; Joshua Kading, Member, Stanley Consultants, Inc, Muscatine, IA; J. Addin Mann III, Ph.D., Member, Iowa State University, Ames, IA

Sunday, June 22, 8 a.m. – 9:30 a.m.

Seminar 1 (Basic)

Analysis Methods for Smoke Management Systems: Back to Basics

Track: Applications

Room D

Sponsor: 5.6 Control of Fire and Smoke; 5.9 Enclosed Vehicular Facilities

Chair: Paul Turnbull, Member, Siemens Building Technologies, Inc., Buffalo Grove, IL

This session provides an introduction to methods that can be used during design of smoke management systems to predict the production, accumulation and movement of smoke under design conditions. The session provides an overview of algebraic equations ("hand calculations"), zone models, network models, and physical models, including the use, applicability, and limitations of each method.

1. Use of Algebraic Equations for Atrium Smoke Management Analysis

Gary Loughheed, Ph.D., Member, National Research Council of Canada, Ottawa, Ontario, Canada

2. Using Zone Models to Develop Smoke Management Strategies

Jeffrey Tubbs, P.E., Member, Arup, Westborough, MA

3. Use of Network Models in Smoke Management Applications

Ahmed H. Kashef, Ph.D., P.E., Member, National Research Council of Canada, Ottawa, Ontario, Canada

4. Assumptions for Physical Modeling

Greg Sanchez, P.E., Member, MTA-New York City Transit, New York, NY

Sunday, June 22, 8 a.m. – 9:30 a.m.

Seminar 2 (Intermediate)

Automated Demand Response: How Your Building Can Participate in the Next Generation Electric Grid

Track: Operational Topics

Room B

Sponsor: 7.4 Building Operation Dynamics

Chair: Srinivas Katipamula, Ph.D., Member, Pacific Northwest National Laboratory, Richland, WA

Buildings account for 40% of the energy consumption in the US. For the most part, peak loads that stress the electric grid are due to HVAC. Concerns about the health of the electric grid and desire to limit emissions and energy consumption are driving standards development efforts to enable automated demand response (DR) by building energy management systems, allowing them to respond to grid events or real-time prices. This seminar discusses developments in standards to enable commercial buildings to participate in automated demand response.

1. Dawn of the Smart Electric Grid Generation

Steven E. Widergren, Pacific Northwest National Laboratory, Richland, WA

2. The Demand Response Automation Server

Ed Koch, Akuacom, San Rafael, CA

3. Developments in BACnet for Building Utility Interaction

David Holmberg, Member, National Institute of Standards and Technology, Gaithersburg, MD

Sunday, June 22, 8 a.m. – 9:30 a.m.

Seminar 3 (Intermediate)



Benchmarking Performance of Ground-Source Heat Pumps in Schools

Track: Benchmarking

Room E

Sponsor: 6.8 Geothermal Energy Utilization

Chair: Gary Phetteplace, Ph.D., P.E., Member, GWA Research LLC, Lyme, NH

This session presents data benchmarking the performance of ground-source heat pump (GSHP) systems in school buildings providing data quantifying the performance of GSHP systems and comparing them to “conventional” HVAC equipment.

1. Ground Source Heat Pumps in Northern Climates: Indian River Central School District’s Experience

John Shonder, Member, Oak Ridge National Labs, Oak Ridge, TN ; James R. Koch, Indian River Central School District, Indian River, NY

2. School Energy Efficiency: Is Efficiency Inversely Proportional to Age?

Kirk T. Mescher, P.E., Member, CM Engineering, Inc., Columbia, MO

3. Performance of GLHE Systems: Jordan School District, SLC, Utah

Cary Smith, Member, Sound Geothermal Corp., Sandy, UT

Sunday, June 22, 8 a.m. – 9:30 a.m.

Seminar 4 (Advanced)

How You Do What You Do When You Do It Where You Do It: The Often Cited but Rarely Sighted Standard of Care

Track: Business Management

Room C

Sponsor: 1.7 Business, Management & General Legal Education; 2.8 Building Environmental Impacts and Sustainability

Chair: Mitchell Swann, P.E., Member, MDC Systems LLC, Paoli, PA

The “Standard of Care” is often referred to and then a frantic search ensues for just where that standard is written. There are a number of issues rocketing through the industry that impact the what, the how, the who and the way work is done and how buildings are received/perceived. Tsunami-like changes are moving thru the industry in project documentation, contracts and performance expectations. This seminar looks at the impacts on the standard of care created by these new issues and technologies.

1. What’s the Buzz about BIM?

Beth Andrus, J.D., Skellenger Bender, Seattle, WA

2. Keeping the ‘Green’ from Turning to Red

Robert Hughes, J.D., Ames & Gough, Inc., West Chester, PA

3. We Could Have Danced All Night!! But We Had to Finish the Project

Mitchell Swann, P.E., Member, MDC Systems LLC, Paoli, PA

Sunday, June 22, 8 a.m. – 9:30 a.m.

Seminar 5 (Advanced)

Oil Circulation Issues of R-22 Alternatives in Supermarket Refrigeration Systems

Track: Refrigeration

Room A

Sponsor: 10.10 Management of Lubricant in Circulation; 10.3 Refrigerant Piping

Chair: Yunho Hwang, Ph.D., Member, University of Maryland, College Park, MD

From 2010, production and consumption of R22 will be frozen. Moreover, it is projected that there could be a shortage of R-22 around 2015. This regulatory action invited an introduction of HFC/hydrocarbon mixtures for the retrofit of R-22 used in existing supermarket refrigeration systems. The addition of small fraction of hydrocarbon to HFC refrigerant reduces the viscosity of mineral oil to aid in oil return to the compressor. Theoretical analysis and experimental experience on the oil circulation behavior of R-22 alternatives are explored.

1. Modeling Results of Oil Retention in Supermarket Refrigeration Systems

Reinhard Radermacher, Ph.D., Member, University of Maryland, College Park, MD

2. Laboratory Studies on Oil Circulation in Supermarket Refrigeration Systems

Thomas J. Leck, Associate Member, Carlos Saldana, Associate Member, DuPont Fluoroproducts, Wilmington, DE

3. Evaluation of R-22 Retrofit Blends for Oil Circulation Performance

Jim Lavelle, Member, National Refrigerants, Inc., Philadelphia, PA

Sunday, June 22, 8 a.m. – 9:30 a.m.

Seminar 6 (Intermediate)

Tools for Sustainable Building Operations, Maintenance and Cost Analysis

Track: Operational Topics

Room F

Sponsor: TRG7 Tools for Sustainable Building Operations, Maintenance and Cost Analysis (SBOMC)

Chair: Nick J. Stecky, Member, NJS Associates, Dover, NJ

In support of ASHRAE's 2006 Strategic Plan, a new Technical Resource Group (TRG) was formed and has been working since the spring of 2007. TRG 7 is concerned with coordinating the development of tools for building owners, operators and maintenance personnel that will promote sustainable construction, operation and renewal. These will include: 1) Training, guidance and tools for building operators; 2) Guidance to enhance the effectiveness of maintenance procedures; and, 3) Lifecycle cost analysis for building owners that will encourage sustainable building construction, operation and renewal. This seminar provides an overview of the work of TRG 7 and the TRG's plans to meet this first Direction of the Strategic Plan.

1. Training, Guidance and Tools

Michael Bobker, Member, CUNY Building Performance Lab, New York, NY

2. Effectiveness of Operations and Maintenance Procedures

Janice Peterson, P.E., Member, Northwest Energy Efficiency Alliance, Portland, OR

3. Lifecycle Cost Analysis

Adam Hinge, P.E., Member, Sustainable Energy Partnerships, Tarrytown, NY

Sunday, June 22, 8 a.m. – 9:30 a.m.

Seminar 7 (Intermediate)

Using Direct Digital Controls as a Tool to Commission Sustainable Buildings

Track: Sustainability

Room G

Sponsor: 1.4 Control Theory and Application; 1.5 Computer Applications

Chair: Frank Shadpour, P.E., Fellow ASHRAE, SC Engineer, Inc., San Diego, CA

The seminar focuses on using direct digital controls (DDC) as a tool to commission and benchmark green and sustainable buildings. The quality and effectiveness of the commissioning process is only as good as the tools that are used. Presentations closely review the requirements, opportunities and obstacles associated with the available building automation technology for commissioning and retro-commissioning of sustainable buildings. The contractor's and engineer's responsibilities, as well as the owner's required commitments, are discussed. Scenarios for specific LEED certified buildings, including hospitals and laboratory buildings are presented.

1. Extensible DDC Tools for Commissioning

Michael A. Pouchak, P.E., Member, Honeywell International, Golden Valley MN,

2. Extensible DDC Tools for Commissioning Sustainable Buildings

Barry B. Bridges, P.E., Member, Sebesta Blomberg and Associates, Saint Paul, MN

3. Commissioning of Green Buildings: Owner's Requirements

James Page, Amylin Pharmaceuticals, San Diego, CA

4. Using BAS in the Sustainable Building Commissioning Process

Jack S. Wolpert, Ph.D., Member, E-Cube, Inc., Boulder, CO

Sunday, June 22, 9:45 a.m. – 11:15 a.m.

Transactions Session 2 (Advanced)

Air, Energy and Contaminant Transport in the Personal Micro-Environment

Track: Fundamentals
Room I

Sponsor: 4.10 Indoor Environmental Modeling

Chair: H. Ezzat Khalifa, Ph.D., Member, Syracuse University, Syracuse, NY

Human exposure to indoor contaminants and thermal comfort are strongly influenced by air, energy and contaminant transport within the personal microenvironment (PME). The PME is significantly affected by interactions with ventilation flow, especially with personal ventilation (PV). This session addresses advances in modeling and experimental validation of the transport of energy, and gaseous and p.m. contaminants within the PME. Of special interest is the effect of human activity (breathing, coughing, motion, etc) and ventilation systems, especially PV, on the PME. Other topics of interest include effects of human shape, posture and location, grid detail, turbulence models and radiative exchange.

1. Improvement of Facial Humidity and Reduction of Pollutant Inhalation in Commercial Aircraft Cabins Via Application of Personalized Ventilation (SL-08-004)

Naiping Gao, Jianlei Niu, Ph.D., Member, Hong Kong Polytechnic University, Hong Kong, China

2. Verification and Validation of CFD for the Personal Micro-Environment (SL-08-005)

Thong Dang, Ph.D., Syracuse University, Syracuse, ; Chris Sideroff, Ph.D., Pointwise, Inc., Ft. Worth, TX

3. Contaminant Flow in the Microenvironment between People under Different Ventilation Conditions (SL-08-064)

Peter V. Nielsen, Ph.D., Fellow ASHRAE, Aalborg University, Aalborg, Denmark; M. Buus, Cowi A/S, Lyngby, Denmark; F. V. Winther, Ramboll A/S, Virum, Denmark; and M. Thilageswaran, Aalborg University, Aalborg, Denmark

Sunday, June 22, 9:45 a.m. – 11:15 a.m.

Transactions Session 3 (Intermediate)

Optimal Control Approaches for Demand Limiting Utilizing Building Thermal Mass

Track: Operational Topics
Room D

Sponsor: 7.4 Building Operation Dynamics; 7.5 Smart Building Systems

Chair: Steven L. Blanc, P.E., Member, PG&E, San Francisco, CA

Managing building thermal mass to cut peak A/C loads cost-effectively and to provide reasonable comfort is a serious challenge. This session addresses optimal use of building thermal mass with demand, energy and comfort considerations.

1. Evaluation of the Primary Factors Impacting the Optimal Control of Passive Thermal Storage (1313-RP) (SL-08-006)

Hwakong Cheng, P.E., Associate Member, Taylor Engineering, Alameda, CA ; Michael J. Brandemuehl, Ph.D., P.E., Member, University of Colorado, Boulder, CO ; Gregor P. Henze, Ph.D., P.E., Member, Anthony R. Florita, Student Member, University of Nebraska, Omaha, NE ; Clemens Felsmann, Ph.D., Technical University of Dresden, Dresden, Germany

2. A Data-Driven Method for Determining Zone Temperature Trajectories that Minimize Peak Electrical Demand (SL-08-007)

James Braun, Ph.D., Fellow ASHRAE, Purdue University, West Lafayette, IN ; Kyong-Ho Lee, Ph.D., Korea Electric Power Corp., Korea, South Korea

3. Optimization of Building Thermal Mass Control in the Presence of Energy and Demand Charges (1313-RP) (SL-08-008)

Michael J. Brandemuehl, Ph.D., P.E., Member, University of Colorado, Boulder, CO ; Gregor P. Henze, Ph.D., P.E., Member, University of Nebraska, Omaha, NE ; Clemens Felsmann, Ph.D., Technical University of Dresden, Dresden, Germany; Anthony R. Florita, Student Member, University of Nebraska, Omaha, NE ; Hwakong Cheng, P.E., Associate Member, Taylor Engineering, Alameda, CA ; Clarence E. Waters, Ph.D., P.E.

Seminar 8 (Intermediate)



ASHRAE's Impact and Potential for Weatherization

Track: Applications

Room A

Sponsor: *SSPC 62.2 and 6.3, Central Forced Air Heating and Cooling Systems*

Chair: *Paul Francisco, Member, University of Illinois, Champaign, IL*

Our homes use about 21 percent of the energy we as a nation use annually (\$160 billion) and contribute about 17 percent of U.S. emissions of greenhouse gases. ASHRAE has helped in the important effort to make our residential buildings energy efficient and healthier with a number of standards, including 62.2, 90.2, 119, 136, and 152. This session gives examples and first-hand experience of how ASHRAE standards have been used – and sometimes misused – within the existing U.S. housing stock by the two major U.S. programs weatherizing homes – DOE's low-income weatherization and EPA's home performance programs.

1. ASHRAE Standards and Existing House Programs

Richard Karg, Member, R.J. Karg Associates, Topsham, ME ; Martha Benewicz, WI Division of Energy Services, New Auburn, WI

2. ASHRAE 62.2 and Existing Homes

Robert Parkhurst, WI Energy Conservation Corporation, Madison, WI

3. ASHRAE and Forced-Air Systems in Existing Homes

Bruce Manclark, Delta-T, Inc., Goldendale, WA

Sunday, June 22, 9:45 a.m. – 11:15 a.m.

Seminar 9 (Basic)

Benchmarking O&M Costs Using the ASHRAE Interactive Database

Track: Benchmarking

Room B

Sponsor: *7.8 Owning and Operating Costs*

Chair: *Bruce B. Lindsay, P.E., Member, Johnson Controls Inc., Madison, WI*

ASHRAE funded the development of an interactive web-based database on owning and maintenance costs of HVAC equipment in buildings. Under RP1336 data from 150 office buildings were input. The emphasis was primarily on central plant equipment. Additional research is planned to provide data on low rise buildings with unitary equipment. This session discusses how the database was developed, how it can be used by design engineers and facility managers to benchmark their buildings, and how the information can assist in specifying equipment with the lowest life cycle cost.

1. Evolution of the O&M Database

James F. Poulos, P.E., Member, Johnson Controls, Atlanta, GA

2. Demonstration of the Database Capabilities

Barry Abramson, P.E., Member, Servidyne, Atlanta, GA

3. Utilizing the Data for Life Cycle Cost Analysis

Carl C. Hiller, Ph.D., P.E., Member, Applied Energy Technology, Davis, CA

Sunday, June 22, 9:45 a.m. – 11:15 a.m.

Seminar 10 (Basic)

Building a Better 2008 Handbook: The First Five Chapters Revised and Updated

Track: Systems and Equipment

Room G

Sponsor: *9.1 Large Building Air-Conditioning Systems*

Chair: *Howard J. McKew, P.E., Fellow ASHRAE, RDK Engineers, Andover, MA*

The first half of this seminar presents the behind-the-scenes process that led up to the revision of these five chapters. The second half of this seminar presents the measures taken to make the electronic ASHRAE Handbook a more powerful technical tool for the 21st century. These revisions were made to comply with standard Handbook reviser requirements as well as following the direction of the ASHRAE Handbook Workshop, which focused on new ways and methods to make the Handbook more user friendly and useful for designers, builders and operators.

1. The Technical Updates to Chapters 1 thru 5

Stephen W. Duda, P.E., Member, Ross & Baruzzini, Inc., St. Louis, MO

2. The Electronic Updates to Chapters 1 thru 5

Sarah E. Maston, P.E., Member, RDK Engineers, Andover, MA

Seminar 11 (Intermediate)

New Research Developments in Load Calculations

Track: Fundamentals

Room C

Sponsor: 4.1 Load Calculation Data and Procedures

Chair: Glenn Friedman, P.E., Member, Taylor Engineering, Alameda, CA

This seminar presents current research findings in lighting heat gain and radiant/convective split, RTS (radiant time series) calculation technique advancements, and kitchen equipment heat gains.

1. Lighting Heat Gains for Load Calculations Splits

Dan Fisher, Ph.D., Member, Oklahoma State University, Oklahoma, OK

2. RTS Load Calculation Method Enhancements

Jeffrey D. Spittle, Dr.Eng., P.Eng., Fellow ASHRAE, Oklahoma State University, Oklahoma, OK

3. Heat Gain from Commercial Kitchen Equipment

Rich Swierczyna, Associate Member, Architectural Energy Corporation, Wood Dale, IL

Sunday, June 22, 9:45 a.m. – 11:15 a.m.

Seminar 12 (Intermediate)

Preventing Legionellosis: Why Move from a Guideline to a Standard

Track: Operational Topics

Room E

Sponsor: 3.6 Water Treatment; Environmental Health Committee (EHC)

Chair: Michael Patton, Member, Clearwater Systems Corporation, Essex, CT

Why should ASHRAE upgrade from a guideline to a standard for preventing Legionellosis? What does this action mean to the ASHRAE membership and the professional building community? To answer this, we'll look at this disease in depth and discover why prevention is worthwhile, and examine the consequences if we do not. We'll look at the overall concept of Risk Management in preventing disease in general, and how this process affects design criteria and operational and maintenance practices.

1. Environmental-source Disease Prevention Using Risk Management

William McCoy, Ph.D., Member, Phigenics, Naperville, IL

2. Using Risk Management to Formulate New Concepts in Design and Performance

Sidney Parsons, Ph.D., P.E., Member, CSIR, Pretoria, South Africa

Sunday, June 22, 9:45 a.m. – 11:15 a.m.

Seminar 13 (Intermediate)

UVGI Application in the Operating Suite

Track: Applications

Room F

Sponsor: 2.9 Ultraviolet Air and Surface Treatment

Chair: Chuck Dunn, Member, Lumalier Corporation, Memphis, TN

The application of ultraviolet germicidal irradiation (UVGI) in the operating suite has been ongoing for decades. New data continues to support the technology's ability to reduce nosocomial infections acquired during invasive procedures. Experts discuss portable UVGI systems to disinfect operating suites before and after procedures and data confirming reduction of contaminate on surfaces, fixed UVGI systems applied during procedures and data confirming reductions in hospital acquired infections, and the effect of these systems on materials within the operating suite. This seminar focuses on these aspects with practical knowledge gained from experience in the field.

1. Portable UVGI Systems and a Method of Area Sterilization

Jeffrey L. Deal, M.D., Roper Hospital, Charleston, SC

2. UVGI Applied During Orthopaedic Surgery and the Rate of Infection

Meredith C. Stines, Member, American Ultraviolet, Lebanon, IN

3. The Effect of In-Room UVGI Systems on Materials Within the Operating Suite

Dave Witham, Member, Ultraviolet Devices Inc. (UVDI), Valencia, CA

SUNDAY, 6/22
11:30 A.M. – 1 P.M.

Sunday, June 22, 11:30 a.m. – 1 p.m.

Transactions Session 4 (Advanced)

Why Don't We Achieve the Desired Energy Results in Our Service Water Heating Systems—Towards Benchmarking

Track: Benchmarking

Room F

Sponsor: 6.6 Service Water Heating

Chair: Wayne Webster, P.Eng., Member, Princess Towers Inc., Ottawa, Ontario, Canada

Service water heating and distribution systems standby losses normally accumulate over the entire year. By contrast, space heating systems only apply for a portion of the year. Results from laboratory and field are provided to allow quantification of losses in these systems. Tankless water heaters provide some relief, but have losses and unique challenges. Comprehensive results are now available to assess the performance of distribution systems. Opportunities for further work and improved installation performance should result from these results.

1. Effect of Temperature Stratification Near Heating Elements on the Measured Energy Factors of Electric Water Heaters (SL-08-009)

William Healy, Ph.D., Member, National Institute of Standards and Technology, Gaithersburg, MD

2. Hot Water Distribution System Piping Heat Loss Factors, Both In-Air and Buried – Phase II Test Results (SL-08-010)

Carl Hiller, Ph.D., Fellow ASHRAE, Applied Energy Technology Co., Davis, CA

3. Hot Water Distribution System Piping Time, Water, and Energy Waste – Phase II Test Results (SL-08-011)

Carl Hiller, Ph.D., Fellow ASHRAE, Applied Energy Technology Co., Davis, CA

Sunday, June 22, 11:30 a.m. – 1 p.m.

Seminar 14 (Advanced)

Airborne Infections in Healthcare Facilities

Track: Operational Topics

Room G

Sponsor: 9.6 Healthcare Facilities

Chair: Jeff Traylor, Member, EMCOR Government Services, Durham, NC

This seminar will address a general overview of airborne infections and specific issues related to airborne infections in hospital operating rooms.

1. Overview of Recent Work on Airborne Infection Issues Conducted at National Institute of Health

Farhad Memarzadeh, Ph.D., P.E., Member, National Institutes of Health, Bethesda, MD

2. Experimental Study of Surgical Wound Temperatures

Sheldon M. Jeter, Ph.D., P.E., Member, Georgia Institute of Technology, Atlanta, GA

3. Comparison of CFD Simulations with PIV Measurements of Hospital Operating Room Air Distribution

Tyler Stevenson, Student Member, Georgia Institute of Technology, Atlanta, GA

Sunday, June 22, 11:30 a.m. – 1 p.m.

Seminar 15 (Advanced)

Predicting the Cooling Loads Due to the Solar Heat Gain of Fenestration

Track: Applications

Room E

Sponsor: 4.5, Fenestration

Chair: William DuPont, Member, Sunergy Consulting, Annapolis, MD

Architects, building scientists and HVAC Engineers have often referred to the ASHRAE Handbook of Fundamentals as a guide in predicting the solar heat gain of windows, doors and skylights in buildings. The solar heat gain generated by fenestration in buildings can be a significant proportion of the total cooling load, depending on the building design and orientation, location, building surroundings, the fenestration system design, the date, and the time of day. With the introduction of better performing complex glazing systems, there is an increasing need for accurate methodologies for predicting the cooling load of fenestration systems. It may be a challenge to include the description of some new cooling load calculation procedures in future versions of the ASHRAE Handbook of Fundamentals. This seminar addresses some proposals.

1. Reality vs. Theory: Fenestration Loads for the HVAC Engineer

- Steven Bruning, Member, Newcomb & Boyd, Atlanta, GA
2. Predicting Fenestration Loads Using TMY Data
Joe Huang, Member, White Box Technologies, Berkeley, CA
 3. Calculation of Cooling Loads for Windows with Interior Shading Using the Heat Balance Method
Charles Barnaby, Member, Wrightsoft Corp., Lexington, MA
 4. Current Methodologies to Rate the Energy Performance of Windows
William McCluney, Ph.D., SunPine Consulting, Chattanooga, TN

Sunday, June 22, 11:30 a.m. – 1 p.m.

Seminar 16 (Intermediate)

Benchmarking TAB for Commissioning

Track: Benchmarking
Room I

Sponsor: 7.7 Testing and Balancing

Chair: Rodney H. Lewis, P.E., Fellow ASHRAE, Rodney H Lewis Assoc., Inc., Houston, TX

TAB firms' roles are increasingly and they are being asked to perform more complex tests in the area of functional performance testing as a part of the commissioning process. This seminar discusses the components and issues with this expanded role.

1. Benchmarking the Functional Performance Test of the Controls
Gaylon Richardson, Fellow ASHRAE, Engineered Air Balance Co., Inc., Houston, TX
2. Benchmarking the Air Side
Gerald J. Kettler, P.E., Member, Air Engineering and Testing, Dallas, TX
3. Benchmarking the Hydronic System
Mark C. Hegberg, Member, ITT Bell & Gossett, Northbrook, IL

Sunday, June 22, 11:30 a.m. – 1 p.m.

Seminar 17 (Intermediate)

Experiences with Alternate Refrigerants as Replacements for R-22 in Commercial Refrigeration

Track: Refrigeration
Room C

Sponsor: 10.7 Commercial Food and Beverage Cooling Display and Storage

Chair: John Gallaher, Associate Member, Hill PHOENIX, Atlanta, GA

There are many refrigerants now available for retrofit applications to replace R-22 in commercial refrigeration systems. It can be rather confusing for the operator to determine which refrigerant is the best choice for their specific application. The experiences of refrigerant and compressor manufacturers as well as an end user are explored in this seminar.

1. Effect of Various HFC Alternatives for R-22 on Compressor Performance
Michael Collins, Bitzer US, East Syracuse, NY
2. Retrofit Experience of HFC Alternative Refrigerants in Supermarket Refrigeration Systems
C. Curtis Lawson, Member, Dupont Fluoroproducts, Wilmington, DE
3. Issues Regarding Retrofit Refrigerants in Commercial Refrigeration Systems
Samuel F. Yana Motta, Member, Honeywell International, Buffalo, NY
4. An End-Users Perspective on the Use of R-422A in Supermarket Refrigeration System Retrofits
George Ronn, Affiliate, Supervalu, Stillwater, MN

Sunday, June 22, 11:30 a.m. – 1 p.m.

Seminar 18 (Intermediate)



Low Energy Residential Applications

Track: Applications
Room D

Sponsor: 9.5 Residential and Small Building Applications

Chair: David A. Schaaf, Jr., Member, Nailor Industries, Houston, TX

These seminar presentations start with lessons learned from honeybees, whom have been practicing temperature, ventilation, air quality control for 90 million years. Then continue on to lessons learned from a significant DOE-TVA residential study. This seminar finishes with methods to reduce base load energy use in residential architecture.

1. Honeybees Control Temperature, Humidity and Air Quality

- Chris Mathis, Member, Mathis Consulting Co., Asheville, NC
2. High Performance Housing: DOE-TVA Studies
David Dinse, P.E., Member, Tennessee Valley Authority (TVA), Chattanooga, TN
 3. Reducing Base Load Energy Use in Residential Architecture
Charles Culp, Ph.D., P.E., Fellow ASHRAE, Texas A&M University, College Station, TX

Sunday, June 22, 11:30 a.m. – 12 p.m.

Seminar 19 (Intermediate)

First Time at an ASHRAE Meeting? This Seminar's for You!

Track: Fundamentals
Room B

Sponsor: Society Program Committee

Chair: Mohammad H. Hosni, Ph.D., Member, Kansas State University, Manhattan, KS

OPEN SESSION — No badge required. This seminar familiarizes first-time meeting attendees with the committee structure of ASHRAE, networking opportunities within the Society and ways to get the most out of ASHRAE meetings.

1. Membership: How to Get the Most Out of an ASHRAE Meeting and Exposition-Networking

Keith C. Newcomer, Member, Piedmont Natural Gas, Fuquay Varina, NC

2. Technical Committees, Standing Committees and Programs

Riyaz A. Papar, Member, Hudson Technologies Co., The Woodlands, TX

3. The Fun Side of ASHRAE Meetings

Joseph S. Ferdelman, P.E., Member, Heapy Engineering, Dayton, OH

Sunday, June 22, 12 a.m. – 1 p.m.

Seminar 20 (Basic)

More Effective Presentations

Track: Business Management
Room B

Sponsor: Society Program Committee

Chair: Alan C. Veeck, Member, Society Program Committee, Virginia Beach, VA

OPEN SESSION — No badge required. Speaking to an audience can be intimidating; however, it is a skill that can be learned, practiced and mastered. This working session will provide attendees with methods and techniques to more effectively present information, especially of a technical nature, to groups. Topics covered include: better use of PowerPoint and other visuals along with creative openings, more credible information in the presentation, and a dynamic Q & A and summary. Your audience will thank you for attending this session.

Sunday, June 22, 11:30 a.m. – 1 p.m.

Forum 1 (Intermediate)



Business and Risk Management Issues Facing Mechanical, Electrical and Plumbing Engineers

Track: Business Management
Room A

Sponsor: Meetings Arrangements Committee

Chair: Robin S. Greenleaf, P.E., Member, Architectural Engineers, Inc, Boston, MA ; Roy C. Wilson, P.E., George Butler Associates, Inc, Lenexa, KS

Experienced leaders from the MEP industry lead a discussion on major business and risk management issues facing mechanical, electrical and plumbing engineers. The business case for building information modeling (BIM), how to market directly to the owner, how to work with architects profitably and how to sell sustainable design/LEED to clients are discussed.

SUNDAY, 6/22
1:10 P.M. – 1:50 P.M.

Sunday, June 22, 1:10 p.m. – 1:50 p.m.

Forum 2 (Intermediate)

ASHRAE Handbook's Industrial Applications Chapters: What's Missing, What's Needed, What Do You Want To See?

Track: Applications

Room G

Sponsor: 9.2 Industrial Air Conditioning

Chair: Leon E. Shapiro, J.D., Member, VRTX Technologies, Las Vegas, NV

TC 9.2 has the responsibility to review and revise 10 of the industrial chapters in the ASHRAE Applications Handbook. Input is sought from the ASHRAE membership on how effective these chapters are in assisting in the design and operation of industrial applications. What is missing, what is needed, and what do you want to see that would make the ASHRAE Handbook a better resource for you?

Sunday, June 22, 1:10 p.m. – 1:50 p.m.

Forum 3 (Advanced)

Calculating Carbon Footprint and Resource Efficiency... Aiming for Consensus!!!

Track: Sustainability

Room B

Sponsor: 1.10 Cogeneration Systems

Chair: Richard Sweetser, Member, Exergy Partners Corp., Herndon, VA

Strong interest in sustainable design and minimizing the carbon footprint of today's building stock requires the development of a simple, repeatable and accurate means of defining and calculating resource energy efficiency and CO₂ emissions. This forum examines several approaches ASHRAE has taken in the past and is currently taking with the intent of developing as consensus approach to this critical metric.

Sunday, June 22, 1:10 p.m. – 1:50 p.m.

Forum 4 (Intermediate)

Expanding the Boundary Conditions of TC4.10: Adding Simulation of the Outdoor, Near Building Zone

Track: Indoor Environmental Modeling

Room E

Sponsor: 4.10 Indoor Environmental Modeling

Chair: Duncan Phillips, Ph.D., P.E., Associate Member, RWDI, Guelph, Ontario, Canada

TC 4.10 Indoor Environmental Modeling has historically been involved in developing, evaluating and recommending procedures for predicting indoor environmental conditions. This has predominantly been thermal and air quality conditions although acoustic and illumination simulations are permitted. Computational fluid dynamics (CFD) is one of the tools addressed by TC4.10. This forum discusses whether TC4.10 should increase the sphere of its responsibilities to include computer simulation of the near field around buildings. This would mean that simulation of natural ventilation, outdoor chemical dispersion and other issues would fall into TC4.10's realm.

Sunday, June 22, 1:10 p.m. – 1:50 p.m.

Forum 5 (Basic)

How Do You Benchmark Operations and Maintenance?

Track: Benchmarking

Room D

Sponsor: 7.3 Operation and Maintenance Management

Chair: John Warfield, Member, URI Environmental Inc., Wilmington, DE

Facility operation and maintenance has long been subjective, equipment specific and with varying degrees of success. This forum discusses the current practices, newer methodologies and attempts to derive a broad consensus on the benchmarking of operations and maintenance. In addition, it is expected to gather vital information, current trends, success stories and failures.

Sunday, June 22, 1:10 p.m. – 1:50 p.m.

Forum 6 (Intermediate)

Should ASHRAE Establish Part-Load Outdoor Design Conditions?

Track: Systems and Equipment

Room F

Sponsor: 8.12 Desiccant Dehumidification Equipment and Components; 1.12 Moisture Management in Buildings

Chair: Lewis Harriman, Member, Mason-Grant, Portsmouth, NH

Designers often assume cooling systems will accomplish dehumidification in addition to sensible cooling. Problems in hot and humid climates have established that many cooling systems fail to adequately dehumidify during off-peak load outdoor conditions. Should ASHRAE help designers and equipment manufacturers by establishing part-load design conditions to use in assessing dehumidification effectiveness? If so, how could the Society go about selecting such conditions? If not, what other means are available to designers and manufacturers to ensure improvement of the current shortcomings of systems with respect to dehumidification?

Sunday, June 22, 1:10 p.m. – 1:50 p.m.

Forum 7 (Basic)

What Do People Want in a Design Guide for Air-to-Air Energy?

Track: Systems and Equipment

Room C

Sponsor: 5.5 Air-to-Air Energy Recovery

Chair: Klas C. Haglid, P.E., Member, Haglid Engineering, Hillsdale, NJ

This forum provides feedback to TC 5.5, Air to Air Energy Recovery, for use in deciding what is needed and would be found useful by ASHRAE members on a practical level to help provide sustainable and ongoing energy savings in commercial and residential buildings.

Sunday, June 22, 1:10 p.m. – 1:50 p.m.

Forum 8 (Intermediate)

What Is Needed in the Handbook Chapter for Retail Facilities?

Track: Applications

Room I

Sponsor: 9.8 Large Building Air-Conditioning Applications

Chair: John Wolfert, P.E., Life Member, Carmel, IN

This forum solicits input from ASHRAE members for revisions to the Handbook chapter for retail facilities. The forum is open to all disciplines for new ideas and material suggestions for inclusion in the Applications Handbook chapter.

SUNDAY, 6/22
2 P.M. – 3 P.M.

Technical Plenary Speaker

Ira Magaziner

Room A

Ira Magaziner, chairman of the Clinton Climate Initiative, is the technical plenary keynote speaker at ASHRAE's 2008 Annual Meeting. As chair of the Clinton Climate Initiative (CCI), formed in August 2006, Magaziner oversees the mission of applying the Clinton Foundation's business-oriented approach to the fight against climate change in practical, measurable and significant ways. ASHRAE is a partner in the Initiative. CCI is working with the C40 Large Cities Climate Leadership Group, an association of large cities dedicated to tackling climate change—to develop and implement a range of actions that will accelerate greenhouse gas emissions reductions. For more information, visit www.clintonfoundation.org. A meeting badge is required to attend this session.

SUNDAY, 6/22
3:15 P.M. – 4:45 P.M.

Sunday, June 22, 3:15 p.m. – 4:45 p.m.

Seminar 21 (Intermediate)



Benchmarking, Greening and LEED Development for Cleanrooms

Track: Applications

Room D

Sponsor: 9.11 Clean Space

Chair: Wei Sun, P.E., Member, Engsysco, Inc., Ann Arbor, MI

Cleanroom facilities present a unique challenge for energy efficiency and sustainable design due to the complexity of systems, high energy consumption, and the environmental, safety and health (ESH) requirements. This seminar presents the latest developments in following areas: (1) Energy benchmarking data for semiconductor facilities which can be used as a good reference and a tool to analyze the efficiencies of different energy-saving schemes; (2) Experimental validations of cleanroom airflow rate determination modeling approach; (3) High efficiency filters test protocols, their commonality, differences and practices; and (4) Defining and developing a "LEED for High-Tech Facilities" protocol to assist in designing and construction of sustainable and energy-efficient high-tech facilities.

1. Energy Benchmark and Application in Semiconductor Facilities

Shih-Cheng Hu, Ph.D., Member, Andy Chang, P.Eng., Koji Toda, P.Eng., National Taipei University of Technology, Taipei, Taiwan

2. Experimental Validations of Cleanroom Airflow Rate Modeling Approach

Wei Sun, P.E., Member, Engsysco, Inc., Ann Arbor, MI

3. High Efficiency Filter Test Standards and Their Practices

R. Vijayakumar, Ph.D., Member, AERFIL, LLC, Syracuse, NY

4. Greening Advanced Technology Facilities

Allan Chasey, Ph.D., P.E., Member, Arizona State University, Tempe, AZ

Sunday, June 22, 3:15 p.m. – 4:45 p.m.

Seminar 22 (Intermediate)

Developments and Progress in Domestic Refrigerators

Track: Refrigeration

Room G

Sponsor: 8.9 Residential Refrigerators and Food Freezers

Chair: Pradeep Bansal, Ph.D., Member, The University of Auckland, Auckland, New Zealand

This seminar presents the latest developments in domestic refrigerators. The four presenters specifically discuss the progress made in the modeling and design optimization of refrigerators, the alternative refrigerator cycles, cycling and defrost issues with domestic refrigerators, and globalization of refrigerator test procedures.

1. Thoughts on Refrigerator Design Optimization

Reinhard Radermacher, Ph.D., Member, University of Maryland, College Park, MD

2. An Overview of Alternative Cycles for Residential Refrigerators

Michael Pate, Ph.D., Member, Iowa State University, Ames, IA

3. Dynamic Liquid Hold Up Behavior in the Accumulator

Yunho Hwang, Ph.D., Member, University of Maryland, College Park, MD

4. Globalization of Refrigerator Test Procedures

David Yashar, Ph.D., Member, National Institute of Standards and Technology (NIST), Gaithersburg, MD

Sunday, June 22, 3:15 p.m. – 4:45 p.m.

Seminar 23 (Intermediate)

Lessons to Be Learned from Failed Moisture Management That Resulted in Litigation

Track: Fundamentals

Room I

Sponsor: 1.12 Moisture Management in Buildings

Chair: Jeff Traylor, Member, EMCOR Government Services, Durham, NC

The three speakers have seen hundreds of buildings where moisture management has failed. Come learn from a some of their experiences.

1. A Moisture Litigious School HVAC System
Ray Patenaude, P.E., Member, The Holmes Agency, Inc., Tierra Verde, FL
2. A Resort Hotel Gone Moldy: Don't Let this Happen to You
Holly Bailey, P.E., Member, Bailey Engineering, Palm Beach Gardens, FL
3. Two Twenty Million \$ Plus Moisture Management Failures in South Texas
Rodney Lewis, P.E., Fellow ASHRAE, Rodney Lewis Associates, Houston, TX

MONDAY, 6/23
8 A.M. – 9:30 A.M.

Monday, June 23, 8 a.m. – 9:30 a.m.

Transactions Session 5 (Intermediate)

Indoor Contaminant Transport Modeling

Track: Fundamentals
Room G

Sponsor: 4.10 Indoor Environmental Modeling

Chair: John Zhai, Ph.D., Member, University of Colorado at Boulder, Boulder, CO

This transaction session presents two papers that address the recent advance in modeling contaminant transport in buildings. The research focuses on the development of new transient modeling methods as well as the model validations and applications for both commercial and residential buildings.

1. Coupled Simulation of a Flow Network Model and 3D Transient Pollutant Transport in a Room Using Concentration Response Factor Method (SL-08-012)

Kyosuke Hiyama, Student Member, Y. Ishida, Dr.Eng., S. Kato, Dr.Eng., Member, University of Tokyo, Tokyo, Japan

2. Transient Simulation of Airflow and Pollutant Dispersion under Mixing and Buoyancy Driven Flow Regimes in Residential Buildings (SL-08-013)

Donghyun Rim, Student Member, Atila Novoselac, Ph.D., Member, University of Texas at Austin, Austin, TX

Monday, June 23, 8 a.m. – 9:30 a.m.

Seminar 24 (Advanced)



Advanced Testing Procedures and Standardization of Solar PV and Thermal Components and Their Buildings' Integration: International Harmonization of Approaches

Track: Applications
Room I

Sponsor: 6.7 Solar Energy Utilization; 4.4 Building Materials and Building Envelope Performance

Chair: Costas Balaras, Ph.D., Member, National Observatory of Athens, Athens, Greece

The ASHRAE Standard 93-1986 "Methods of Testing to Determine the Thermal Performance of Solar Collectors" was launched as one of the first in the world on solar energy, and its impact on the related solar ISO products was fundamental. Even the most recently updated ISO version has only a few additions to the early ASHRAE source. Acceleration of solar energy utilization outlines the need for energy efficient solar equipment manufacturing and globally harmonized advanced cost-effective solar components testing procedures. The aim of this seminar is to review corresponding scientific, technical and commercial/economical problems, outlining needs for future research and appropriate international actions.

1. Rated Versus Installed Performance of Building Integrated Photovoltaic Products
Brian Dougherty, Dr.Eng., P.Eng., Member, NIST, Gaithersburg, MD
2. Dynamic Performance Determination of PV, Thermal and Hybrid PV/Thermal Integrated in Buildings Structures
Marija S. Todorovic, Ph.D., Member, University of Belgrade, Belgrade, Serbia
3. Alternative Test Methods for Solar Thermal Collectors
Sanford Klein, Ph.D., Member, University of Wisconsin, Madison, WI

Monday, June 23, 8 a.m. – 9:30 a.m.

Seminar 25 (Intermediate)

ARI Standard 550/590: What It Is, What It Isn't

Track: Fundamentals

Room C

Sponsor: 8.2 Centrifugal Machines

Chair: Justin P. Kauffman, Member, JCI, York, PA

Chiller performance data can provide useful information when analyzing overall building performance. This seminar presents an overview of chiller factory and field testing. An overview of ARI 550/590 factory testing is presented from a chiller manufacturers perspective; AHRI will describe the 550/590 certification process; and field testing are compared and contrasted with factory testing.

1. ARI Standard 550/590 Overview

Rick M. Heiden, Member, Trane, La Crosse, WI

2. Monitoring, Enforcement and the Meaning of Certification

Saunders C. Smith, Member, AHRI, Arlington, VA

3. Factory Versus Field Testing: What's the Difference?

John I. Vucci, Member, University of Maryland, College Park, MD

Monday, June 23, 8 a.m. – 9:30 a.m.

Seminar 26 (Basic)

Benchmarking CKV System Performance

Track: Benchmarking

Room B

Sponsor: 5.10 Kitchen Ventilation

Chair: Derek Schrock, Member, Halton Company, Scottsville, KY

This session presents research as well as practical advice to engineers on how-to means and methods of benchmarking the real performance of commercial kitchen ventilation systems. Topics discussed include how generic and assorted listed hoods perform when subjected to a standard appliance challenge, how to benchmark a commercial kitchen to determine how sustainable and efficient it really is, and the scope of on-going research to validate and measure true hood performance in the field.

1. Laboratory Comparison of Wall-Canopy Hood Performance Using ASTM F1704

Donald Fisher, P.E., Associate Member, Fisher-Nickel, Inc., San Ramon, CA

2. How Do You Benchmark Sustainable Kitchens?

Anthony J. Spata, P.E., Member, Chipman Adams + Defilippis Architects, Inc., Park Ridge, IL and Frank Kohout, McDonalds Corp., Oak Brook, IL

3. ASHRAE Developing CKV Field Performance MOT: Research Update

Stephen L. Brown, Member, LC Systems, Columbus, OH

Monday, June 23, 8 a.m. – 9:30 a.m.

Seminar 27 (Intermediate)

Exchanging Information Between EMCS and FDD Tools for Better Building Performance: Challenges and Lessons Learned

Track: Operational Topics

Room D

Sponsor: 7.5 Smart Building Systems; 1.4 Control Theory and Application

Chair: John House, Ph.D., Member, Natural Resources Council Canada, Varennes, QC, Canada

Faults that exist in HVAC systems greatly affect building performances by causing significant energy waste and unsatisfactory indoor environment. Although many automated fault detection and diagnosis (AFDD) tools exist, very few buildings adopt such tools. One challenge that prevents wide application of AFDD tools is the difficulty in exchanging data with building Energy Management and Control Systems (EMCS). Researchers and engineers who have extensive experience in deploying AFDD tools in real buildings will share their experiences and methodologies in this seminar.

1. EMCS Data Exchange Challenges: The Really Story!

Srinivas Katipamula, Ph.D., Member, PNNL, Richland, WA

2. Dealing with a Flood of Data: Standard Models and XML Schemas for Sensor Data Exchange

William M. Healy, Ph.D., Member, NIST, Gaithersburg, MD

3. Data Acquisition from Building Control System to Support FDD

Peng Xu, Ph.D., P.E., Member, LBNL, Berkeley, CA

4. EMCS Data Exchange for Commissioning

Reinhard Seidl, P.E., Member, Taylor Engineering Inc., Alameda, CA

Seminar 28 (Intermediate)

Heat Exchanger Benchmark and Performance Analysis Using CFD Methods, Part 1

Track: Benchmarking

Room F

Sponsor: 1.3 Heat Transfer and Fluid Flow; 8.5 Liquid-to-Refrigerant Heat Exchangers

Chair: Jon Hatfield, Trane Co., Lacrosse, WI; Amir Jokar, Ph.D., Member, Washington State Uni., Vancouver, WA

Computational Fluid Dynamics (CFD) is a powerful research tool that can be used for thermal/fluid systems analysis, design, and optimization. Utilizing the CFD software packages in complicated systems, such as heat exchangers, can save time and money for many mechanical engineers who do research on benchmark and performance analysis of these systems. This seminar in two parts, I and II, reviews some of the new studies in this area from both academic and industry points of view.

1. CFD Modeling of a Microchannel Heat Exchanger

Joseph Dix, Student Member, Washington State Uni., Vancouver, WA

2. CFD Flow Simulation of an Automotive Size Evaporator

Steve O'Halloran, Ph.D., Member, Uni. of Portland, Portland, OR

Monday, June 23, 8 a.m. – 9:30 a.m.

Seminar 29 (Advanced)

HVAC&R Research Seminar

Track: Fundamentals

Room E

Chair: Reinhard Radermacher, Ph.D., Fellow ASHRAE, University of Maryland, College Park, MD

Authors who have recently published in the HVAC&R Research publication will present their papers and have a Q&A session.

1. Evaporator Air-Side Fouling: Effect on Performance of Room Air Conditioners and Impact on Indoor Air Quality

Ahmed Hamza Ali, Dr. Eng., Professor, Oberhausen, Germany

2. Axial Flow Characteristics Within a Screw Compressor

Nikola Stosic, Ph.D., City University, London, United Kingdom

3. Dynamic Behavior of Mobile Air Conditioning Systems

Yunho Hwang, Member, University of Maryland, College Park, MD

4. Experimental and Theoretical Analysis of Refrigerant Absorption to Lubricant Oil

Jader Barbosa, Ph.D., Federal University of Santa Catarina, Florianopolis, Brazil

Monday, June 23, 8 a.m. – 9:30 a.m.

Seminar 30 (Intermediate)

Thermal Comfort in Subways

Track: Applications

Room A

Sponsor: 2.1 Physiology and Human Environment; 5.9 Enclosed Vehicular Facilities

Chair: Edward A. Arens, Ph.D., Member, UC Berkeley, Berkeley, CA

This seminar discusses the comfort and safety of thermal environments in rapid transit systems. Design requirements for heating, cooling, and ventilation are described, along with modern simulation tools and case studies of several types of design and operation strategies. A field study of thermal comfort expectations in transit spaces suggests the range of acceptable temperatures in such spaces.

1. Subway Thermal Environment Study and Application

Yingxin Zhu, Ph.D., Tsinghua Univ, Beijing, China

2. Field Survey of Thermal Comfort in Train Stations

Junta Nakano, Ph.D., Tokai University, Kanagawa, Japan

3. Evaluating Thermal Comfort in Subways: Current Challenges, Modeling Techniques, Simulations, and Design Recommendations

Yanzheng (Don) Guan, Ph.D., P.E., Member, Arup, New York, NY; Hui Zhang, Ph.D., UC Berkeley, Berkeley, CA

4. Sustainable Ventilation Design of a Modern Subway System

Mohammad Tabarra, Ph.D., CEng., Member, Arup, London, United Kingdom

MONDAY, 6/23
9:45 A.M. – 10:45 A.M.

Monday, June 23, 9:45 a.m. – 10:45 a.m.

Transactions Session 6 (Basic)

Emergency Evacuation and Smoke Control in High-Rise Office Buildings

Track: Fundamentals
Room F

Sponsor: 5.6 Control of Fire and Smoke; 4.3 Ventilation Requirements and Infiltration

Chair: Ray Sinclair, Ph.D., Member, RWDI, Guelph, Ontario, Canada

This session discusses occupant response during emergencies in high-rise office buildings, particularly situations with smoke-filled egress routes. It provides an overview of evacuation issues and the effects on smoke control design. It is anticipated that this background information may improve safety and reduce cost of smoke control systems in the future.

1. An Overview of Evacuation Analysis with Application to Smoke Control Systems (SL-08-014)

John Klote, Dr.Eng., P.Eng., Fellow ASHRAE, Retired, Leesburg, VA ; George Hadjisophocleous, Ph.D., P.E., Member, Carleton University, Ottawa, Ontario, Canada

2. Smoke Control and Occupant Evacuation at the World Trade Center on September 11, 2001 (SL-08-015)

Michael J. Ferreira, P.E., Member, Steven M. Strege, P.E., Member, Hughes Associates, Inc., Baltimore, MD ; Richard D. Peacock, Jason D. Averill, National Institute of Standards and Technology, Gaithersburg, MD

3. Human Behavior and Evacuation Movement in Smoke (SL-08-016)

Guylene Proulx, Ph.D., National Research Council Canada, Ottawa, Ontario Canada; Rita F. Fahy, Ph.D., National Fire Protection Association, Quincy, MA

Monday, June 23, 9:45 a.m. – 10:45 a.m.

Transactions Session 7 (Intermediate)

Modeling Data Center Airflow and Cooling Performance

Track: Applications
Room I

Sponsor: 4.10 Indoor Environmental Modeling; 9.9 Mission Critical Facilities, Technology Spaces and Electronic Equipment

Chair: H. Ezzat Khalifa, Member, Syracuse University, Syracuse, NY

Sensitive electronics equipment housed in datacenters must receive sufficiently cool air to operate reliably. As datacenters are huge consumers of energy, there is great incentive to provide the required cooling as efficiently as possible despite unique facility and cooling architectures, continued rise of equipment power dissipation, large variations in power and airflow requirements among neighboring equipment, and the transient nature of computer workload. Predictions of datacenter airflow and cooling performance are needed to optimize datacenter architecture before initial build-out or equipment changes. This session addresses CFD and other novel computational techniques for modeling datacenters airflow and cooling.

1. Coarse-Grid CFD: The Effect of Grid Size on Data Center Modeling (SL-08-017)

James VanGilder, Member, Xuanhang Zhang, American Power Conversion, North Billerica, MA

2. Airflow and Cooling Performance of Data Centers: Two Performance Metrics (SL-08-018)

Magnus K. Herrlin, Ph.D., Member, ANCIS, San Francisco, CA

Monday, June 23, 9:45 a.m. – 10:45 a.m.

Transactions Session 8 (Intermediate)



Performance of Insulated Glazing Systems

Track: Sustainability
Room D

Sponsor: 4.5 Fenestration

Chair: Anil Parekh, P.Eng., Member, Natural Resources Canada, Ottawa, Ontario, Canada

Solar gains through the insulated glazing systems play a key role in determining the space heating and cooling loads and thermal comfort of occupants. For the design and specifications of appropriate glazing systems for the building, the design engineer needs both thermal and solar-optical performance parameters. This session covers the new calculation methods for determining the centre-glazing performance parameters for

the non-structural glazing layers, and glazing systems with shading devices. A third paper provides the field monitoring results of low- and high-solar heat gain insulated-glazing units at a full-sized research house test facility.

1. Highly Insulating Glazing Systems Using Non-Structural Center Glazing Layers (SL-08-019)

Dariush Arasteh, Member, Howdy Goudey, Member, Christian Kohler, Member, Lawrence Berkeley National Laboratory, Berkeley, CA

2. Calculating Centre-Glass Performance Indices of Glazing Systems with Shading Devices (SL-08-020)

John L. Wright, Ph.D., P.E., Member, University of Waterloo, Waterloo, Ontario, Canada

3. Summer and Winter Field Monitoring of High and Low Solar Heat Gain Glazing at a Canadian Twin House Facility (SL-08-021)

Marianne M. Manning, Mike C. Swinton, P.Eng., Member, A. Hakim Elmahdy, Ph.D., P.E., Member, National Research Council Canada, Ottawa, Ontario, Canada; Anil Parekh, P.Eng., Member, Natural Resources Canada, Ottawa, Ontario, Canada; Christopher Barry, P.Eng., Member, Pilkington North America Inc., Toledo, OH; F. Szadkowski, Natural Resources Canada, Ottawa, Ontario, Canada

Monday, June 23, 9:45 a.m. – 10:45 a.m.

Transactions Session 9 (Intermediate)

Testing a New Commercial CHP Technology in the 21st Century: A 10 RT Gas Engine Heat-Pump

Track: Systems and Equipment

Room E

Sponsor: 1.10 Cogeneration Systems

Chair: Richard Sweetser, Member, Exergy Partners Corp., Herndon, VA

It is well known that air conditioning drives peak electric demand which in turn leads to high electricity prices, grid instability, power quality problems and overall system inefficiency. Developing new HVAC technologies to reduce electric demand in today's commercial market is very challenging. Two papers chronicle laboratory and field performance testing of a 10RT (35kW) gas engine-driven heat pump rooftop unit.

1. Laboratory Evaluation: Performance of a 10 RT Gas-Engine-Driven Heat Pump (SL-08-022)

Abdi Zaltash, Dr.Eng., Member, Edward Vineyard, Dr.Eng., Member, Randy Linkous, Patrick Geoghegan, Dr.Eng., Randall Wetherington, Oak Ridge National Laboratory (ORNL), Oak Ridge, TN; Isaac Mahderekal, P.E., Associate Member, TEAM Consulting, Las Vegas, NV

2. Field Tested Cooling Performance of Gas Engine-Driven Heat Pumps (SL-08-023)

Chang W. Sohn, Dr.Eng., Member, Franklin H. Holcomb, U.S. Army Engineer Research and Development Center, Champaign, IL; Dudley J. Sondeno, Member, James M. Stephens, Member, Southwest Gas Corporation, Las Vegas, NV

Monday, June 23, 9:45 a.m. – 10:45 a.m.

Seminar 31 (Intermediate)

Lubrication of Variable Speed Compressors

Track: Refrigeration

Room C

Sponsor: 3.4 Lubrication

Chair: Curt R. Slayton, P.Eng., Member, Consulting Services Int'l LLC, Louisville, KY

Variable speed compressors have unique lubrication criteria, particularly when operating at very low or very high speeds. The oil pump mechanism must provide adequate lubrication to the compressor bearings under all operating conditions. At low operating speeds, centrifugal oil pumps may not provide sufficient oil lift to ensure an adequate quantity of oil is always available. At very high speeds, cavitation in the oil may prevent effective bearing lubrication. This seminar addresses the design criteria for effective lubrication of variable speed compressors.

1. Lubrication of Variable Speed Compressors

Alex Lifson, Member, Carrier Corporation, Syracuse, NY

2. Oil Pump Considerations for Variable Speed Compressors

John R. Williams, Member, Bristol Corporation, Bristol, VA

Monday, June 23, 9:45 a.m. – 10:45 a.m.

Seminar 32 (Basic)

Olympic Bobsled Tracks: Design and Construction Challenges

Track: Refrigeration

Room G

Sponsor: 10.2 Automatic Icemaking Plants and Skating Rinks; 10.1 Custom Engineered Refrigeration Systems

Chair: Wayne Borrowman, P.Eng., Member, CIMCO Refrigeration, Delta, British Columbia, Canada

One of the premier venues for any Olympic games is the sliding track for the bobsled, luge, and skeleton events. It is a very different facility from the other venues and involves many design considerations that are unique including a complex refrigerated track surface as well as a large central refrigeration plant. Park City near Salt Lake City is home to one of very few such facilities in North America and the site for the 2002 Salt Lake Olympic Winter Games. It continues to be used as an active training center for athletes. This session discusses the design considerations and construction challenges for this facility, as well as discusses some of the different challenges and improvements that occurred in the design and construction of the Whistler Sliding Centre which will be used in the 2010 Vancouver Olympic Games.

1. Engineering Design Challenges

F. David Baranowski, P.E., Van Boerum & Frank Associates, Salt Lake City, UT

2. Construction and Operational Challenges

Wayne Dilk, P.Eng., Member, CIMCO Refrigeration, Edmonton, Alberta, Canada

Monday, June 23, 9:45 a.m. – 10:45 a.m.

Forum 9 (Intermediate)

Benchmarking Energy Use in Hospitals

Track: Benchmarking

Room B

Sponsor: 9.6 Healthcare Facilities; 9.6 Healthcare Facilities

Chair: Carl N. Lawson, Life Member, Hanson Professional Services, West Palm Beach, FL

With energy consumption continuing to rise and becoming more expensive it is apparent the energy in hospitals continues to rise and is at times out of control. In this forum we identify areas where we can benchmark energy usage and assist in curtailing energy use in hospitals.

Monday, June 23, 9:45 a.m. – 10:45 a.m.

Forum 10 (Intermediate)

What Role Should ASHRAE Take in Creating HVAC Standards and Guidelines for Controls, Pressurization and Filtration of Non-traditional Clean Spaces?

Track: Systems and Equipment

Room A

Sponsor: 9.11 Clean Space; 1.4 Control Theory and Application

Chair: Roger Lautz, P.E., Member, HGA A/E, Milwaukee, WI

Sterile processing, operating rooms, protective environment rooms, museums, food processing and other non-traditional clean spaces have had significant attention lately. ASHRAE has not adequately addressed these areas with standards or guidelines. At least one other organization is publishing a ventilation standard for sterile processing in June of 2008. This forum discusses what role, if any, ASHRAE should take in these areas.

MONDAY, 6/23
11 A.M. – 12 P.M.

Monday, June 23, 11 a.m. – 12 p.m.

Transactions Session 10 (Intermediate)

Motor Bearing Currents: Cause, Effect and Mitigation

Track: Systems and Equipment

Room C

Sponsor: 1.11 Electric Motors and Motor Control

Chair: John W. Tolbert, Member, Bristol Compressors, Bristol, VA

This program explores the fundamental mechanisms as to why and how electrical currents can contribute to damage in the bearings of HVAC machines that are powered by variable frequency drives. Various solutions for prevention of this phenomena are discussed as well.

1. Different Types of Bearing Currents: The Fundamentals (SL-08-024)

Michael J. Melfi, Baldor/Reliance Electric, Richmond Heights, OH

2. Motor Bearing Currents – Cause, Effect and Mitigation (SL-08-025)

H. William Oh, Adam Willwerth, Member, Electro Static Technology, Mechanic Falls, ME

Monday, June 23, 11 a.m. – 12 p.m.

Transactions Session 11 (Advanced)



Reduction of Refrigeration Loads

Track: Refrigeration
Room A

Sponsor: 10.8 Refrigeration Load Calculations; 10.9 Refrigeration Application for Foods and Beverages

Chair: Daniel Dettmers, Member, IRC, U.W. Madison, Madison, WI

This session provides the latest information on two methods to reduce loads on refrigerated facilities. The first paper is the summary of ASHRAE Research Project 1210, which reveals the effects of moisture absorption/desorption on refrigerated facilities. The second paper details a method for determining the rate of infiltration into a product freezers.

1. Rates of Moisture Sorption from Food Packaging Materials (1210-RP) (SL-08-026)
Don Cleland, Ph.D., Member, John Bronlund, Ph.D., Member, Inge Merts, Ph.D., Massey University, Palmerston North, New Zealand;
David Tanner, Ph.D., Member, Zespri International Ltd, Mt Manganui, New Zealand
2. Infiltration Rate Determination for Low Temperature Freezing Systems (SL-08-027)
Douglas Reindl, Ph.D., P.E., Member, Todd Jekel, Ph.D., P.E., Member, IRC, U.W. Madison, Madison, WI

Monday, June 23, 11 a.m. – 12 p.m.

Seminar 33 (Basic)



Airspeed and Duct Leakage Measurements

Track: Applications
Room F

Sponsor: 1.2 Instruments and Measurement

Chair: Stephen Idem, Ph.D., Member, Tennessee Tech University, Cookeville, TN

A recently upgraded airspeed calibration facility at the National Institute of Standards and Technology (NIST) is described. Low values of measurement uncertainties over an airspeed range of 0.15 m/s to 40 m/s are reported. Airflow leakage data are presented for several spiral seam flat oval duct systems under both positive and negative pressure. The resulting leakage class values are compared to data reported previously in the literature.

1. Airspeed Measurement Capabilities at NIST
Michael Hall, Member, NIST, Gaithersburg, MD
2. Measurement and Analysis of Flat Oval Duct System Leakage Rates
Stephen Idem, Ph.D., Member, Tennessee Tech University, Cookeville, TN

Monday, June 23, 11 a.m. – 12 p.m.

Seminar 34 (Intermediate)

Benchmarking Performance of Ventilated and Non-Ventilated Attics, Part 1

Track: Applications
Room G

Sponsor: 4.4 Building Materials and Building Envelope Performance; 4.4 Building Materials and Building Envelope Performance

Chair: David L. Roodvoets, Member, DLR Consultants, Montague, MI

Attics are evolving based on the needs to reduce the energy used and provide more sustainability to the building. There have been many claims of ways to save energy and improve building performance by changing the design of attics. Some practices are counter-productive to producing zero energy homes. This seminar brings the latest information on attic performance from North America and Europe. Benchmarks for attic insulation and ventilation are suggested. Some of subjects covered are: saving energy without compromising performance, the value of ventilated and non-ventilated attics, airtight construction, fact or myth. Ventilation benchmarks for hot and cold climates.

1. Fire, Hurricane, Temperature, Condensation and Energy Considerations of Vented and Unvented Roof Assemblies
Joseph Lstiburek, Ph.D., ASHRAE Fellow, Building Science Corp., Westford, MA
2. Benchmark for Engineered Attic Environments
Raoul A. Webb, P.Eng., Member, M&F Engineering, Brandon, FL
3. Reducing Energy Demand of a Typical Residential Attic
Andre O. Desjarlais, Member, Oak Ridge National Laboratory, Oak Ridge, TN

Seminar 35 (Intermediate)



Do M/E's Need to Worry About Risk Management?

Track: Business Management

Room E

Sponsor: Meetings Arrangements Committee

Chair: Alfred W. Woody, P.E., Fellow ASHRAE, Ventilation/Energy Applications, PLLC, Norton Shores, MI

Normally the risk and, consequently, the liability insurance premiums for M/Es are lower than most other disciplines. That is changing as more M/Es are being drawn into lawsuits, while not necessarily being liable. Learn how to avoid these situations and what to do if you find yourself in one. This session is presented by the Council of American Mechanical and Electrical Engineers (CAMEE), a coalition of the American Council of Engineering Companies (ACEC) dedicated to providing its members with timely information on business practices and risk management tools.

1. Do M/E's Need to Worry About Risk Management?

Velma Lane, Van Gilder Insurance Corp., Denver, CO

2. Do M/E's Need to Worry About Risk Management?

Jeff Hirst,

Monday, June 23, 11 a.m. – 12 p.m.

Forum 11 (Intermediate)

Are Load Methods Keeping Up with Zero Energy Strategies?

Track: Fundamentals

Room B

Sponsor: 4.1 Load Calculation Data and Procedures

Chair: Gary Wingfield, P.E., Fellow Life Member, The Haskell Company, Jacksonville, FL

Heat balance and radiant time series were introduced by ASHRAE in 2005 as the newest, most advanced load calculation technology. Are these load calculation techniques sufficiently robust to deal with current green building designs including non-well mixed spaces such as displacement ventilation, underfloor air distribution and other zero energy strategies?

Monday, June 23, 11 a.m. – 12 p.m.

Forum 12 (Intermediate)

Resource Consumption Between Air-Cooled and Water-Cooled Systems: Where Do We Draw the Line?

Track: Fundamentals

Room D

Sponsor: 8.6 Cooling Towers and Evaporative Condensers

Chair: Leon E. Shapiro, J.D., Member, VRTX Technologies, Las Vegas, NV; Susanna Hanson, Member, Trane, La Crosse, WI

Increasingly, the HVACR industry is looking at the relationship between "point of use" energy/water consumption and "point of [energy] production" energy/water consumption in determining the total resource consumption of buildings and the individual systems within them. The debate over the total efficiencies of water-cooled versus air-cooled condensing systems has been central to many of these examinations. This forum explores this question further and elicits comments on how far the assessment of "point of production" consumption needs to go in order to maximize total resource conservation. Ideas expressed within this forum provide the basis for future ASHRAE programs and research.

Monday, June 23, 11 a.m. – 12 p.m.

Forum 13 (Intermediate)

What Changes Are Needed to Chapter 42 on HVAC Commissioning in the 2007 Applications Handbook?

Track: Fundamentals

Room I

Sponsor: 7.9 Building Commissioning

Chair: John P. Castelvechchi, P.E., Member, Shultz and James, Inc., Richmond, VA

The Handbook subcommittee of TC7.9 is seeking member input on changes or additional information needed in the Handbook chapter on HVAC Commissioning.

Tuesday, June 24, 8 a.m. – 9:30 a.m.

Seminar 36 (Intermediate)**Are 'Green' Materials Healthy?**

Track: Applications

Room F

Sponsor: *Environmental Health Committee (EHC)*Chair: *Jianshun S. Zhang, Ph.D., Member, Syracuse University, Syracuse, NY*

Green materials refer to recycled or low emitting materials that reduce the life cycle impacts including energy consumption, indoor pollution, or adverse impact on climate. However, there are unknown and unintended health implications for some of the "green" materials in the market place or in practices of designing green buildings. The objectives of this seminar are to: 1) Present scientific data that compare the type of compounds and levels of emissions from "green" vs. conventional building materials and furnishings; 2) Discuss guidelines for material selection in green building system design; and 3) identify knowledge gaps to fill in order to minimize/eliminate the unintended adverse health implications.

1. What's A Green Material?: Many Views, Questions and Issues

Hal Levin, P.E., Fellow ASHRAE, Building Ecology, Santa Cruz, CA

2. Chemical Emissions from Green Versus Conventional Building Materials: The California Experience

Leon Alevantis, P.E., Member, California Department of Public Health, Sacramento, CA

3. Low-emitting Office Workstations: Standards, Testing, and Relationship to Occupant Exposure

Jensen Zhang, Ph.D., Member, Syracuse University, Syracuse, NY

Tuesday, June 24, 8 a.m. – 9:30 a.m.

Seminar 37 (Intermediate)**Climate Optimized Cooling: Improved Energy Efficiency and Better Rating Standards**

Track: Benchmarking

Room A

Sponsor: *6.3 Central Forced Air Heating and Cooling Systems; 9.5 Residential and Small Building Applications*Chair: *Mark Cherniack, Associate Member, New Buildings Institute, White Salmon, WA*

Optimizing unitary air conditioners for regional climate conditions would substantially raise energy performance and reduce utility carbon emissions. Federal legislation is in place to establish multiple climate-based efficiency standards. Performance data from optimized equipment is available. Changes to current rating methods are needed.

1. Energy Efficiency Options for Residential Space Conditioning in Hot, Humid Climates

Hugh Henderson, P.E., Member, CDH Energy, Cazenovia, NY

2. Optimizing Energy Efficiency for Space Conditioning in Hot, Dry Climates

John Proctor, P.E., Member, Proctor Engineering Group, San Raphael, CA

3. Potential Cooling Performance Improvements from Regional Standards

Harvey Sachs, Ph.D., Member, American Council for an Energy Efficient Economy, Washington, DC

Tuesday, June 24, 8 a.m. – 9:30 a.m.

Seminar 38 (Intermediate)**Improving Building Performance by Using the IAQ Procedure**

Track: Applications

Room B

Sponsor: *SSPC 62.1*Chair: *Duane Rothstein, Associate Member, McQuay International, Minneapolis, MN*

Application of the IAQ procedure can improve building energy performance and improve the indoor environment. A form of the IAQ procedure has been incorporated in ASHRAE's ventilation standard since 1973. The current IAQ procedure is an alternative to the ventilation rate procedure. The IAQ procedure is not as well defined as the ventilation rate procedure and because of the lack of standardized procedures, it is less frequently used. This session seeks to recommend a basic methodology for using the IAQ procedure that can be used as a model for specific sustainable applications. The presenters include former chair of the test method committee for Standard 52.2 and current chair of SPC 145P.

1. The IAQ Procedure: What, When and Why?

Barney Burroughs, Presidential Fellow Member, Building Wellness Consultancy Inc., Alpharetta, GA

2. Equivalent Air Quality: Air Cleaning as a Replacement for Ventilation Air

Christopher Muller, Member, Purafil Inc., Doraville, GA
3. Designing with the IAQ Procedure
Hoy Bohanon, P.E., Member, Bohanon Engineering PLLC, Winston-Salem, NC

Tuesday, June 24, 8 a.m. – 9:30 a.m.

Seminar 39 (Basic)



Issues Update I: Why Policymakers Finally Discovered Energy Efficiency, and the Approaches They're Taking

Track: Fundamentals
Room G

Sponsor: *Advocacy Committee*

Chair: *Doug Read, Associate Member, ASHRAE, Washington, DC*

Increasing numbers of federal, state and local policymakers have identified energy use and climate change as major issues needing attention. The panel identifies the perfect storm that brought about this change in attitudes. Legislation and other initiatives to increase energy efficiency and reduce greenhouse gas emissions (particularly related to buildings) are discussed. Such initiatives include tax, utility and other incentive programs, building code changes, research and development, and green building requirements.

1. How Did We Get to Today?

Jim Crawford, Fellow ASHRAE, Trane, Tyler, TX

2. Federal Activities in Energy Efficiency

Steve Nadel, Member, American Council for an Energy Efficient Economy, Washington, DC

3. Why States and Cities Have Taken the Lead

Dianne Nielson, Ph.D., Office of the Governor, Salt Lake City, UT

Tuesday, June 24, 8 a.m. – 9:30 a.m.

Seminar 40 (Basic)

Natural Refrigerant Applications with IAR

Track: Refrigeration
Room D

Sponsor: *10.1 Custom Engineered Refrigeration Systems*

Chair: *Kirsten E. McNeil, Affiliate, IAR, Arlington, VA*

This reformulated version of the old "Taste of IAR" session features an in-depth look at ammonia refrigeration design for the food industry and uses of ammonia in air conditioning. An important application that many may not be aware of is ammonia refrigeration in central air conditioning plants. This seminar focuses on the central plant of a community college in a major metropolitan area. Both designer and end user presents their experience with the system. Come learn about how ammonia is playing an important, environmentally-friendly role in our food safety cold chain as well as comfort cooling.

1. Ammonia Use in Central Chilling Plant for Comfort Cooling and More

Michael Whitcomb, Montgomery College, Takoma Park, MD

2. Ammonia Central Cooling Plant Design and Installation

Rudy Nechay, Industrial Refrigeration Service, Baltimore, MD

3. Future Trends in Ammonia Refrigeration Design

Jeff Welch, Freeze-Pro, Orange Park, FL

Tuesday, June 24, 8 a.m. – 9:30 a.m.

Seminar 41 (Intermediate)

Systems Manuals: Will They Be Used and Sustained?

Track: Operational Topics
Room C

Sponsor: *7.3 Operation and Maintenance Management; 7.9 Building Commissioning*

Chair: *Thomas E. Cappellin, P.E., Member, Hanson Professional Services Inc., West Palm Beach, FL*

When construction work on new or existing buildings is finished, it is customary for the owner's operations staff to be provided with a systems manual to be used during their training in successful operation and maintenance procedures needed for installed HVAC&R equipment and assemblies. The O&M staff needs to retain the systems manual as a resource in their ongoing operation and maintenance activities during building occupancy. There is concern that the systems manual will not be properly utilized and maintained to ensure successful system performance.

1. A Commissioning Authority's Experience

William J. McCartney, P.Eng., Member, Isotherm Engineering Ltd., Mississauga, Ontario, Canada

2. An Owner's View

Davidge Warfield, Member, URI Environmental, Inc., Pottstown, PA

3. An Operator's View

Shailen Verma, P.Eng., Member, Regional Municipality of Durham., Whitby, Ontario, Canada

Tuesday, June 24, 8 a.m. – 9:30 a.m.

Seminar 42 (Intermediate)

Using Variable Air Volume Systems to Achieve High Performance Laboratory Buildings, Part 1: Selecting the Right System

Track: Applications

Room E

Sponsor: 9.10 Laboratory Systems

Chair: Jim Coogan, P.E., Associate Member, Siemens Building Technologies, Buffalo Grove, IL

Labs are designed to provide safe and productive environments for research involving potentially hazardous materials. The EPA and DOE report that labs use 7 to 10 times more energy than the average buildings, of which 60% is consumed by HVAC systems. Proper selection, design and operation of VAV systems can achieve high performance labs that are safe and sustainable. Part 1 describes the selection and design of variable air volume systems. Part 2 indicates techniques to ensure proper performance of VAV systems.

1. Design Options for Lab Air Flow Controls

Jim Coogan, P.E., Associate Member, Siemens Building Technologies, Buffalo Grove, IL

2. Do You Always Utilize High Performance Hoods?

Wade Conlan, P.E., Member, X-nth, Maitland, FL

3. Increase Building Performance with Proper Lab HVAC and Exhaust Selection

Roland Charneau, P.E., Member, Pageau Morel and Associates, Montreal, Quebec, Canada

TUESDAY, 6/24
9:45 A.M. – 10:45 A.M.

Tuesday, June 24, 9:45 a.m. – 10:45 a.m.

Transactions Session 12 (Intermediate)

Fire and Smoke Control in Tunnels

Track: Applications

Room B

Sponsor: 5.9 Enclosed Vehicular Facilities; 5.6 Control of Fire and Smoke

Chair: Kai Kang, Ph.D., P.E., Member, Jacobs, New York, NY

Tunnels represent a unique type of enclosed vehicular facilities. Control of fire and smoke in tunnels is important and there has been world-wide interest and effort from research, regulation to practice. This session presents an overview of the latest development on regulation, standards and guideline documents which are globally recognized and discussed the latest application of computer modeling on smoke control in tunnels.

1. Road Tunnel Ventilation and Fire Control: Regulations, Standards and Guidelines (SL-08-028)

Arthur G. Bendelius, P.E., Member, A & G Consultants, Inc., Big Canoe, GA

2. Fire and Smoke Control in Road Tunnels: A Case Study (SL-08-029)

Ahmed H. Kashef, Ph.D., P.E., Member, National Research Council of Canada, Ottawa, Ontario, Canada

Tuesday, June 24, 9:45 a.m. – 10:45 a.m.

Seminar 43 (Basic)

100 Year Anniversary of the IIR: What Does This Mean for ASHRAE Members?

Track: Refrigeration

Room D

Sponsor: USNC/IIR

Chair: Eckhard A. Groll, Dr. Eng., Fellow ASHRAE, Purdue University, West Lafayette, IN

In 2008, the International Institute of Refrigeration (IIR) celebrates its 100 year anniversary. Based in Paris, the IIR is a scientific and technical organization with a mission to promote knowledge of refrigeration technology in all its applications including air-conditioning, food safety, and cryogenics. Considering IIR's international penetration and activities, IIR is relatively little known to the broad ASHRAE membership. This seminar introduces the audience to the IIR and ASHRAE-IIR partnership agreement, and discuss how HVAC&R professionals can benefit from IIR's program, publications and services.

1. Video Commemorating the Centennial of the International Institute of Refrigeration

Eckhard A. Groll, Dr. Eng., Fellow ASHRAE, Purdue University, West Lafayette, IN
2. IIR Activities Worldwide: Scope, Focus and Perspectives

Mark Menzer, Member, AHRI, Arlington, VA
Tuesday, June 24, 9:45 a.m. – 10:45 a.m.

Seminar 44 (Intermediate)



Exemplary Policy Responses to Climate Change

Track: Applications
Room C

Sponsor: 2.5 Global Climate Change

Chair: Jim Crawford, Fellow ASHRAE, Trane, Tyler, TX

Climate Change requires a spectrum of policy changes by national and local governments to mitigate the severity of the effects of the emerging climate changes. This seminar presents examples of policy responses in the United States and Europe.

1. California Early Action for Climate Change Mitigation

Whitney Leeman, CARB, Sacramento, CA

2. The EU Energy Performance of Buildings Directive and Related EU Legislation

Randall Bowie, Rockwool International A/S, Hedehusene, Denmark

Tuesday, June 24, 9:45 a.m. – 10:45 a.m.

Seminar 45 (Intermediate)



Issues Update II: Performance Based Energy Labels for Buildings

Track: Benchmarking
Room G

Sponsor: Advocacy Committee

Chair: Darryl Boyce, P.E., Member, Carleton University, Ottawa, Ontario, Canada

Understanding actual performance of buildings and being able to compare that performance with other buildings has been identified as a critical need for understanding and implementing energy goals. Building labeling requirements are a logical outcome of this need. The European Union already has implemented a requirement of all public buildings to receive energy certifications and prominently display the results. Programs in other countries also are in development. ASHRAE has begun development of its own program. Such performance labels could encourage energy efficiency and differentiate top performers in the marketplace. Speakers examine the schemes being developed, the requirements for a label system in the U.S. and possible future uses for data displayed on labels.

1. The European Approach to Building Labeling

David Arnold, Ph.D., Member, Troup Bywaters & Anders, Reading, United Kingdom

2. Making Building Performance Metrics Meaningful: Texas's Residential Certificate Program

Jeff Haberl, Ph.D., P.E., Member, Texas A&M University, College Station, TX,

3. Using Performance Metrics in Future Greenhouse Gas Programs

Hal Levin, P.E., Member, Building Ecology Research Group, Santa Cruz, CA

Tuesday, June 24, 9:45 a.m. – 10:45 a.m.

Seminar 46 (Basic)

Panel of Existing Benchmarking and Metrics Affecting the Data Center

Track: Benchmarking
Room F

Sponsor: 9.9 Mission Critical Facilities, Technology Spaces and Electronic Equipment

Chair: Christian Belady, P.E., Associate Member, Microsoft, Redmond, WA

This panel of speakers provides an overview of various metrics that have emerged and will be deployed in data centers in the coming years. Metrics for data center efficiency and server efficiency are highlighted by the following organizations: SPEC, EPA/DOE, The Green Grid and Climate Savers. The attendees should get a good overview of metrics and benchmarks they should be considering.

1. Michael Patterson, Ph.D., P.E., Member, Intel, Hillsboro, OR – representing Climate Savers Computing Initiative

2. Tahir Cader, Ph.D., Spraycool, Liberty Lake, WA – representing The Green Grid

3. Kushagra Vaid, Microsoft, Redmond WA – representing SPEC

4. William Tschudi, P.E., Member, Lawrence Berkeley Laboratory, Berkeley, CA – representing the DOE

Tuesday, June 24, 9:45 a.m. – 10:45 a.m.

Seminar 47 (Intermediate)

VRF Heating in Northern Climates

Track: Systems and Equipment

Room E

Sponsor: TGS Variable Refrigerant Flow (VRF)

Chair: Norm Maxwell, P.E., Member, Environmental Air Quality, Great Neck, NY

This seminar discusses new capabilities and performance of utilizing heat pump technology in cold climates.

1. Low Ambient Heating Performance of VRF Systems

Chris Bellshaw, Member, Daikin USA, Carrollton, TX

2. Utilizing VRF Systems for Heating

Paul L. Doppel, Member, Mitsubishi Electric, Suwanee, GA

Tuesday, June 24, 9:45 a.m. – 10:45 a.m.

Forum 14 (Basic)



Water Reuse Opportunities for Sustainable Buildings

Track: Applications

Room A

Sponsor: 3.6 Water Treatment

Chair: Jon J. Cohen, Member, H-O-H Chemicals, Inc, Palatine, IL

This forum discusses different methods of water reuse in building systems. There are many ways water is recycled for use in secondary methods. The options and how a transactions session might be structured to educate ASHRAE membership are discussed.

TUESDAY, 6/24
11 A.M. – 12:30 P.M.

Tuesday, June 24, 11 a.m. – 12:30 p.m.

Seminar 48 (Advanced)

Balancing Energy and Water Conservation in HVAC Cooling Systems: A Total Consumption Approach

Track: Systems and Equipment

Room B

Sponsor: 8.6 Cooling Towers and Evaporative Condensers

Chair: Leon E. Shapiro, J.D., Member, VRTX Technologies, Las Vegas, NV

Energy and water use and conservation have been important considerations in the design and operation of HVAC systems. Increasingly the examination of the balance between energy and water is looking beyond just the “point of use” of HVAC systems to the “point of production” of the energy required to operate these same HVAC systems. Local, state and national standards, such as California Title 24 and ASHRAE Standard 90.1, have begun to look at the macro picture of energy and water use in determining the overall efficiencies of various HVAC systems. This seminar examines the balance between water and energy in HVAC cooling systems; provide some answers to the underlying question of water-cooled vs. air-cooled systems; and lay the groundwork for future ASHRAE programs dealing with this important issue.

1. A Comprehensive Comparison of Air- and Water-Cooled Chillers Over a Range of Climates

Mark Hydeman, P.E., Fellow ASHRAE, Taylor Engineering, Alameda, CA

2. Minimizing Water Use in Non-Compressor Cooling Applications

Mark Modera, P.E., Member, Western Cooling Efficiency Center, Davis, CA

3. Opportunities for Water Conservation in HVAC System Design and Operation

Michael S. Sherber, P.E., Member, Buro Happold, New York, NY

Tuesday, June 24, 11 a.m. – 12:30 p.m.

Seminar 49 (Intermediate)



Benchmarking the Sustainability of Mechanical Insulations: Materials Largely Ignored from a Carbon Reduction Standpoint

Track: Benchmarking
Room D

Sponsor: 1.8 Mechanical Systems Insulation

Chair: William S. Miller, Knauf Insulation, Shelbyville, IN

Mechanical insulation products are largely ignored from a sustainability standpoint. This seminar instructs the audience of the role mechanical insulations play in energy efficiency and carbon reduction strategies.

1. Benchmarking the Degree of Sustainability of Mechanical Insulation Systems in Various Insulation System Scenarios

William S. Miller, Member, Knauf Insulation, Shelbyville, IN

2. Benchmarking the Mechanical Insulation Impact on the Sustainability of a Particular Commercial Building

Patrick Noonan, Member, Knauf Insulation, Shelbyville, IN

3. Benchmarking Mechanical Insulation System Performance with Time

Gordon Hart, P.E., Member, Artek Engineering, LLC, Boston, MA

Tuesday, June 24, 11 a.m. – 12:30 p.m.

Seminar 50 (Intermediate)

High Temperature Applications of Applied Heat Pump/Heat Recovery Systems: Getting from the Past to the Future

Track: Applications
Room C

Sponsor: 9.4 Applied Heat Pump/Heat Recovery Systems

Chair: Jeff K. Smith, Associate Member, Georgia Power Company, McDonough, GA

Applied heat pump/heat recovery systems were used throughout the 1970's and 1980's and even into the early 1990's for doing everything from heating service water to drying products. The heat pumps used a number of CFC refrigerants including CFC-113 and CFC-114. Unfortunately, installations fell with the phase-out of these refrigerants. The purpose of this seminar is to help bridge the gap between these old applications and the new equipment becoming available with new refrigerants.

1. Commercial Applications of Heat Pump/Heat Recovery Systems

Scott Hutto, P.E., Member, Gulf Power Company, Pensacola, FL

2. Industrial Applications of Heat Pump/Heat Recovery Systems

Frank Pucciano, Member, Jacoby Energy Development, Inc., Atlanta, GA

3. Where is High Temperature Heat Pump Technology Heading?

Tom E. Watson, P.E., Member, McQuay International, Staunton, VA

Tuesday, June 24, 11 a.m. – 12:30 p.m.

Seminar 51 (Advanced)

Nanofluids for HVAC&R?

Track: Refrigeration
Room A

Sponsor: 8.5 Liquid-to-Refrigerant Heat Exchangers; 1.3 Heat Transfer and Fluid Flow

Chair: Steven J. Eckels, Ph.D., Member, Kansas State University, Manhattan, KS ; Amir Jokar, Ph.D., Member, Washington State University, Vancouver, WA

Nanofluids research is at the leading edge of thermal/fluid sciences, and there are still many unknowns that need to be investigated. This seminar reviews some of the new studies in this area with the possible applications in HVAC&R industry.

1. Boiling with Refrigerants and Nanolubricants

Mark A. Kedzierski, Ph.D., Member, NIST, Gaithersburg, MD

2. Unexpected Findings from Experimental Investigation of Nucleate Boiling with Gold Nanofluids

James E. Bryan, Ph.D., Member, University of Missouri, Columbia, MO

3. Two-Phase Flow-Boiling of Refrigerant-Based Nanofluid in a Horizontal Tube

Liping Liu, Ph.D., Student Member, University of Illinois, Urbana, IL

Tuesday, June 24, 11 a.m. – 12:30 p.m.

Seminar 52 (Intermediate)



Quantifying the Environmental Impact of Buildings with Life Cycle Assessment

Track: Applications
Room G

Sponsor: 2.8 Building Environmental Impacts and Sustainability

Chair: Michael Deru, Ph.D., Member, NREL, Golden, CO

As we move forward in our quest to make more environmentally sensitive buildings, we need more sophisticated tools to provide the necessary feedback on performance. Life cycle assessment (LCA) is one of these tools and will be included in ASHRAE Standard 189 and LEED. So, what is LCA and how will it impact ASHRAE members? This seminar covers the basics of LCA and provides an overview of how recent trends in LCA affect the buildings industry. In addition, the seminar covers how eco-labels and environmental product declarations impact builders and manufacturers. Finally, the seminar covers LCA tools available to engineers and architects for buildings and building materials.

1. Introduction to LCA and How It Fits into the Buildings Industry

Nuno da Silva, PE Americas, Boston, MA

2. What Eco-Labels and Environmental Performance Declarations Mean for Builders and Manufacturers

Paul Bertram, Member, North American Insulation Manufacturers Association, Alexandria, VA

3. LCA Tools for Buildings and LEED

Wayne Trusty, Athena Institute, Merrickville, Ontario, Canada

Tuesday, June 24, 11 a.m. – 12:30 p.m.

Seminar 53 (Intermediate)

Using VAV Systems to Achieve High Performance Laboratory Buildings, Part 2: Ensuring Performance

Track: Applications
Room E

Sponsor: 9.10 Laboratory Systems

Chair: Wade H. Conlan, P.E., Member, X-nth, Inc., Maitland, FL

Labs are designed to provide safe and productive environments for research involving potentially hazardous materials. The EPA and DOE report that labs use 7 to 10 times more energy than the average buildings, of which 60% is consumed by HVAC systems. Proper selection, design and operation of VAV systems can achieve high performance labs that are safe and sustainable. Part 1 described the selection and design of VAV systems. Part 2 indicates techniques to ensure proper performance of VAV systems.

1. TAB and Cx Requirements for a High Performance Lab

Gaylon Richardson, Fellow ASHRAE, Engineered Air Balance Co., Inc., Houston, TX

2. VAV Optimization in a Geochemistry Lab Building: Unique Challenges and Benchmarking

Peter Gardner, Member, Torcon, Mountainside, NJ

3. Commissioning in the Lab and Building

Tim Hayes, Newmatic Engineering, San Diego, CA

Tuesday, June 24, 11 a.m. – 12:30 p.m.

Seminar 54 (Intermediate)



Utilizing VFD for Building HVAC System Performance

Track: Systems and Equipment
Room F

Sponsor: 5.1 Fans; 5.9 Enclosed Vehicular Facilities

Chair: Aresh Raychaudhuri, P.E., Member, US dept. of Veterans Affairs, Washington, DC

Use of variable frequency drive for different HVAC systems in a building in relation to ASHRAE Standard 90.1 is discussed. Other methods related to controlling system operation for energy savings and improving system performance together with the benefits and problems also are discussed.

1. Overview of the Basics on the Use of VFD

Chuck Coward, P.E., Member, Weddell Engineering Company, Moorestown, NJ

2. Total Energy Management of Building Systems Including Fan Operation

Michael R. Olson, Member, ABB Inc., New Berlin, WI

3. Applying VFD in HVAC systems: The Potential and the Pitfalls

Ken Fonstad, Danfoss HVAC&R, Milwaukee, WI

Poster Session

Room I

The European Directive on Energy Performance of Buildings (EPBD): The EPBD Buildings Platform

(SL-08-033)

Dick van Dijk, TNO Research Organization, Delft, Netherlands; Peter Wouters, Ph.D., Belgium Building Research Institute (BBRI), St. Stevens-Woluwe, Belgium

This paper provides an overview of the Directive 2002/91/EC of the European Parliament and Council on energy efficiency of buildings ("Energy Performance of Buildings Directive", EPBD) and the activities of the EPBD Buildings Platform. The EPBD Buildings Platform is a European Commission initiative in the framework of the Intelligent Energy – Europe (2003-2006) programme, which provides information services for practitioners and consultants, experts in energy agencies, interest groups and national policy makers in the European Member States for helping the implementation of the European Energy Performance of Buildings Directive (EPBD).

Long-Term Ground Temperature Changes in Geo-Exchange Systems (SL-08-034)

Michel Bernier, Ph.D., P.Eng., Member, Ecole Polytechnique De Montreal, Montreal, Canada; Antoine Chala, P.Eng., Member, LBCD-Trow Consulting, Montreal, Quebec, Canada; Patrice Pinel, Arsenal Research, Vienna, Austria

This paper examines thermal interaction among boreholes in geo-exchange systems with vertical ground heat exchangers. Borehole thermal interaction is caused by ground thermal imbalances and results in long-term ground temperature changes which can have a significant impact on bore field sizing and heat pump performance. Long-term temperature changes are quantified in this paper using the concept of temperature penalty, T_p , which represents an effective increase (or decrease) of the undisturbed ground temperature to account for borehole thermal interactions. A comparison is made with current values of T_p found in the ASHRAE Handbook (ASHRAE, 2003). Finally, a general correlation, adequate for engineering calculations, is proposed to estimate T_p .

Partitioning of Non-Condensable Gases in Refrigerant Liquid and Vapor Phases (RP-1303) (SL-08-035)

Richard C. Cavestri, Ph.D., Life Member, Donna Seever-Clevenger, Imagination Resources, Inc., Dublin, OH

The distribution of non-condensable gases (NCG's) nitrogen and dry air in refrigerant liquid and vapor is determined at temperatures in the range of 3°F (-16°C), 65°F (18.3°C) and 130°F (54.4°C) at five different partial pressures (5, 15, 30, 45 and 60 psi) in each of eight refrigerants (R-22, 123, 124, 134a, 404A, 407C, 410A and 507). The distribution is determined by measuring the concentration of the NCG (nitrogen or dry air) in the liquid and in the vapor phases after equilibrium is achieved. Gas solubility equations for each refrigerant are developed from the resulting values.

Determine the Mechanism for Copper Plating and Methods for the Elimination from HVAC Systems

(RP-1249) (SL-08-036)

Robert E. Kauffman, University of Dayton Research Institute, Dayton, OH

Copper plating on steel parts continues to be a problem for all types of compressors operating with HCFC and HFC refrigerant systems. When the copper plating reaches a critical thickness, it causes compressor failures through failed bearings or seized parts. However, the mechanism by which copper plating occurs is not well understood. Consequently, a research program consisting of literature searches, field sample analyses, sealed tube tests and refrigerant/oil circulating tests was performed in order to determine the mechanism of copper plating in refrigeration and air-conditioning systems. The information from the literature search and tests was used to identify compounds and maintenance practices to inhibit specific steps of the proposed copper plating mechanism.

A Procedure for the Performance Evaluation of a New Commercial Building, Part 1: Calibrated As-Built Simulation

(SL-08-037)

Suwon Song, Ph.D., Yonsei University, Seoul, South Korea; Jeff S. Haberl, Ph.D., P.E., Member, Texas A&M University, College Station, TX

Whole-building simulation models that are calibrated to measured data can be used to evaluate the energy performance of a new commercial building. In this paper, a detailed as-built simulation is calibrated against measured data. Several significant factors were found to enhance the DOE-2 calibration for the case-study building, including: 1) Supply and outside air (OA) flow rates, 2) Building thermal mass, 3) Exhaust air flow rates, 4) Hot deck air temperature, and 5) Specific procedures for compiling synthetic solar radiation compared to measured data.

A Procedure for the Performance Evaluation of a New Commercial Building, Part 2: Overall Methodology and

Comparison of Methods (SL-08-038)

Suwon Song, Ph.D., Yonsei University, Seoul, South Korea; Jeff S. Haberl, Ph.D., P.E., Member, Texas A&M University, College Station, TX

The concept of the measurement and verification (M&V) of a new building is becoming more important because efficient design alone is often not sufficient to deliver an efficient building. However, there is a lack of standard M&V methods to measure the performance of a new construction that has energy conservation design measures (ECDMs), including the selection of the base-case building. This study presents an enhanced method based on calibrated whole-building simulation (Song and Haberl 2007) for evaluating the energy performance of new com-

mercial buildings and demonstrates its use using a case-study building.

Thermodynamic Properties For Humid Air and Engineering Correlation (SL-08-039)

Jose A. Perez Galindo, Ph.D., Member, Luis A. Payan Rodriguez, Instituto Tecnologico de Durango, Durango, Mexico

A recent paper presented a model of saturated air properties, based on polynomial curve fits of required variables, whose only inputs are pressure and temperature but needed to be completed to include other humidity contents. This work presents the development of a similar model for dry air properties and procedures to calculate humid air properties at any humidity content. The latter were based on the use of the degree of saturation and include provisos for the three most common humidity related measurements: relative humidity, wet bulb temperature and dew point temperature. Model results were evaluated, in the range of 0.0 to 1.0 relative humidity, with respect to values calculated with the real gas model predictions for dry and saturated air properties.

Hydrodynamic Lubrication of Scroll Compressor Thrust Bearing with Grooves and Circular Pockets

(SL-08-040)

Amit Vaidya, Farshid Sadeghi, Ph.D., Purdue University, West Lafayette, IN

This theoretical work concentrates on improvement in the lubrication performance of the scroll compressor thrust bearing undergoing an orbital motion. In order to achieve the objective, the thrust surface is patterned with various surface features such as grooves (triangular, circular and trapezoidal) and circular pockets. The analytical model was developed to predict the hydrodynamic pressure distribution and film thickness at the thrust interface of an orbiting scroll. An isothermal, time-dependent polar coordinate Reynolds equation containing both radial and tangential velocity components was solved using a control volume finite difference approach.

Emulating Nature: Evaporative Cooling Systems (SL-08-041)

Sanjeev Jain, Ph.D., Member, Indian Institute of Technology, Delhi, New Delhi, India

Direct and indirect evaporative cooling options have been extensively used, with the direct one (in the form of desert coolers and air washers) being more common. Evaporative cooling systems typically have much higher circulation and ventilation rates, thus these are used over an extended comfort zone. But its use is still limited by the ambient wet bulb temperature and wet bulb depression. It is possible to increase its range of applicability by multi-staging that improves the performance of the system substantially. One of the options of multi-staging is termed as regenerative cooling, which is achieved by a combination of direct and indirect evaporative cooling with recirculation of part of the process air. The performance of a regenerative evaporative cooler has been studied over a wide range of outdoor conditions and its potential to provide comfort for many cities in India has been explored in the paper.

A New Approach to the Modeling of the Ground Heat Exchangers in the Initial Phase of Heat Flux Build-Up (SL-08-042)

Gopal Bandyopadhyay, Associate Member, Manohar Kulkarni, Ph.D., P.E., Member, Michael Mann, Ph.D., University of North Dakota, Grand Forks, ND

For the design or simulation of ground-source heat pump systems, knowledge of the thermal response characteristics of the borehole heat exchanger in the early stage of a step heat input is essential. In a real system, the heat flux across the borehole boundary builds up gradually as the rise of the fluid temperature is dampened by the thermal mass of the aggregate fluid. Presently the analytical models used are based on a steady flux assumption, while the thermal capacity of the fluid is ignored. Consequently, they have limited usefulness for predicting early stage behavior. In this paper, a classical analytical solution has been used to model the temperature response of the fluid directly. This also uses the thermal capacity of the fluid as a key variable. The results are validated through Finite Element Modeling (FEM).

A Numerical Estimate of Flexible Short-Tube Flow and Deformation with R-134a and R-410a (SL-08-043)

Ramadan Bassiouny, Ph.D., Minia University, Minia, Egypt; Dennis L. O'Neal, Ph.D., P.E., Member, Texas A&M University, College Station, TX

A finite element model was used to estimate the refrigerant flow through flexible short-tubes for two refrigerants and three moduli of elasticity. The short-tubes were 14.5 mm (0.57 in.) in length and undeformed inlet diameter of 2.06 mm (0.081 in.) and outlet diameter of 2.46 mm (0.097 in.). The study included two refrigerants: R-134a and R-410a, and short-tubes with three moduli of elasticity: 5513, 7084, and 9889 kPa (800, 1025, and 1434 psi). A finite element model was developed using a commercially available software package. The model captured deformation by coupling the fluid/short-tube structural interaction in the short-tube. Upstream pressures were set to correspond to typical condensing temperatures for each refrigerant. The model estimated tube deformation and refrigerant flow as a result of upstream pressure changes.

Air Leakage Analysis of Special Ventilation Hospital Rooms (SL-08-044)

Andrew Geeslin, Andrew Streifel, University of Minnesota, Minneapolis, MN ; Gary Nelson, Member, The Energy Conservatory, Inc., Minneapolis, MN

Hospitals use special ventilation (SPV) rooms (AII and PE) to protect patients and employees from airborne spread infectious diseases. The room airtightness determines the effectiveness of the ventilation system at containing airborne spread diseases. We tested special ventilation (SPV) rooms utilizing duct pressurization equipment to determine room leakage area. This study describes a method for testing room leakage area, suggests a method to trace and seal leakage sites, and make recommendations for an airtightness standard that is achievable based on the measurements.

Field and Laboratory Testing of Gas Tankless Water Heater Performance (SL-08-045)

Marc A. Hoeschele, P.E., David A. Springer, Member, Davis Energy Group, Davis, CA

This paper describes field and laboratory monitoring of residential scale tankless gas water heaters. The new breed of tankless gas water heaters that have entered the market in the past ten years offer the potential to reduce residential domestic hot water energy use by replacing the conventional center flue storage water heater design. The goal of this study was to evaluate field and laboratory performance of two tankless

units to develop a better understanding of real world performance.

VOC Removal Performance of Pellet/Granular Type Sorbent Media: From Testing to Predictions (SL-08-046)

Jinjing Pei, Student Member, Jianshun Zhang, Ph.D., Member, Sunil Nair, Wenhao Chen, Ph.D., Student Member, Bing Guo, Syracuse University, Syracuse, NY ; Joseph Wong, Ph.D., Xerox Corp., Webster, NY

Laboratory testing of the pollutant removal performance of sorbent media is typically conducted under relatively high concentration conditions (ppm level). This paper presents a mechanistic model-based method and procedure to use the laboratory test data for predicting the performance of the sorbent bed under relatively low concentration levels (ppb level) that are typically found in indoor environment. A mathematical model including its analytical solution is presented and evaluated for its applicability. Methods are developed to determine the key model parameters based on the laboratory test data assisted by theory of VOC diffusion and sorption in porous media. The modeling method is first validated with experimental data, and then applied to design a sorbent-bed-based air cleaner for a residential house. The simulation results matched with experimental data well, and the model is demonstrated to be useful for predicting the performance of air cleaners.

Heat Tolerance Limits for Subjects Exercising in Heavy Clothing

(SL-08-047)

T. Jang, H. Cline, K. Pietarila, A. Iyoho, J. Gall, Satish S. Nair, Ph.D., P.E., Member, University of Missouri, Columbia, MO

Two new predictive neural network models are reported to estimate (i) core temperature and heart rate, and (ii) time tolerance limits, for subjects exercising in heavy clothing. Although limited to young fit males, the models account for individual variability, and are applicable over a wide range of warm environments and heavy impermeable clothing levels. The relative importance of relevant subject anthropomorphic parameters, environmental parameters, and work rates on the subject's tolerance time to uncompensable heat stress can also be evaluated via a proposed sensitivity analysis.

Modeling Office Building Occupancy in Hourly Data-Driven and Detailed Energy Simulation Programs

(SL-08-048)

Bass Abushakra, Ph.D., Member, Milwaukee School of Engineering, Milwaukee, WI ; David E. Claridge, Ph.D., P.E., Member, Texas A&M University, College Station, TX

Four different occupancy variables are compared with use of the results of a detailed occupancy survey in data driven multi-variable regression analysis of building cooling data. The results of regression models using the different occupancy variables are compared with synthetic data from two simulations of a large building, one with VAV and one with CAV systems. The results suggest that a simple linear transformation treating occupancy level as being linearly proportional to the difference between lighting and equipment consumption and the minimum value of this consumption is comparable to using a detailed, more demanding, occupancy survey.

Energy Impact of Residential Ventilation Standards in California

(SL-08-049)

Iain S. Walker, Ph.D., Member, Max H. Sherman, Ph.D., Member, Lawrence Berkeley National Laboratory, Berkeley, CA

The California Energy Commission is considering upgrading the State energy code, known as Title 24, to require mechanical ventilation based on the requirements of ASHRAE Standard 62.2-2004, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings. These requirements will call for mechanical ventilation systems to be installed in virtually all new homes, but allows for a wide variety of design solutions. These solutions, however, may have different energy costs and non-energy benefits. The authors have used a detailed simulation model to evaluate the energy impacts of common and proposed mechanical ventilation approaches for a variety of climates. These results separate the energy needed to condition the ventilation air from the fan energy needed to distribute and/or temper the ventilation air.

Field and Laboratory Evaluation of A New Ramping Technique for Duct Leakage Testing (SL-08-050)

Iain S. Walker, Ph.D., Member, Darryl J. Dickerhoff, Lawrence Berkeley National Laboratory, Berkeley, CA

The DeltaQ duct leakage test has been developed over the past several years as an alternative to duct pressurization testing. A new ramping technique for obtaining the measured data has been developed in order to increase resolution at low envelope pressures and to make the test quicker and easier to perform. This study performed laboratory and field testing to investigate the bias and precision of the ramping technique and to determine test limits and recommendations for good practice. The laboratory testing compared the DeltaQ testing results to known measured leakage on a specially built tight duct system with known added leaks to evaluate potential biases and showed that the biases for the ramping test are typically less than 1% of system blower flow, with a range of zero to 1.5% of system blower flow.

Energy Implications of Meeting ASHRAE Standard 62.2 (SL-08-051)

Iain S. Walker, Ph.D., Member, Max H. Sherman, Ph.D., Member, Lawrence Berkeley National Laboratory, Berkeley, CA

The first and only nationwide standard for residential ventilation in the United States is ASHRAE Standard 62.2-2004. This standard is being considered for adoption by various jurisdictions within the U.S. as well as by various voluntary programs. The adoption of 62.2 would require mechanical ventilation systems to be installed in virtually all new homes, but it allows for a wide variety of design solutions. These solutions, however, may have different energy costs and non-energy benefits. The authors have used a detailed simulation model to evaluate the energy impacts of common and proposed mechanical ventilation approaches for a variety of climates.

The Barriers and Possibilities of Heat Supply Sustainability (SL-08-052)

Ladislav Boszormenyi, Technical University of Kosice, Kosice, Slovakia; Gabriel Boszormenyi, Ingersoll Rand Climate Control Technologies, Hostovice, Czech Republic

Conventional technologies based on use of fossil fuels contribute to the environmental load very significantly. Increasing efficiency of heat supply resulting in rational use of fossil fuels is a primary condition of sustainable energy supply. This increase is limited by the validity of basic laws of thermodynamics. Moreover, despite maximum effectiveness of fossil fuels' utilization sustainability of energy supply is limited to several decades. This paper describes some basic approaches in favor of long-term sustainability under conditions of the European Union.

Modeling the Heat Gain of a Window With an Interior Shade, How Much Energy Really Gets In? (SL-08-053)

Douglas C. Hittle, Ph.D., Fellow ASHRAE, Colorado State University, Fort Collins, CO ; Peter Simmonds, Ph.D., Fellow ASHRAE, IBE Consulting Engineers, Sherman Oaks, CA

Not long ago the ASHRAE Technical Committee on Load Calculation, TC 4.1, had a "bake off" of sorts between different peak air-conditioning load calculation schemes and programs. One of the outcomes of this exercise was the realization that practitioners and software developers make largely different assumptions about how solar energy absorbed by window glass and by window shades contributes to the room solar heat gain. For a shade however, there were two extremes in the models. What we have done is to avoid any simplifying assumptions in formulating the problem while allowing that some physical constants, convection coefficients in particular, are not well known and need to be parameterized. We whet the readers' appetite by revealing that for a glass/shade system where the glass was 22% transmissive and the shade 52% transmissive, the total heat gain to the room from this window assembly was nearly half of the incident radiation.

Granular Filtration for Airborne Nanoparticles (SL-08-054)

Laleh Golshahi, Student Member, Zhongchao Tan, Member, Jalal Abedi, University of Calgary, Calgary, Alberta, Canada

Despite the promising applications of granular filtration, there is a shortage of literature for its application for airborne nanoparticles in indoor environments. Accordingly, a pack-bed granular filter with body diameter (D) of 25.4 cm was designed and evaluated using 2-mm, 4-mm and 6-mm uniform glass beads as the bed media. Experiments were conducted at three air flow rates, 23, 54 and 70 liters per minute, each at bed thicknesses of 0.1D, 0.333D and 0.5D. The particle filtration efficiencies were 90% or higher for particles with diameters between 10 nm and 100 nm.

Optimized Operation of Combined Chilled Ceiling Displacement Ventilation System Using Genetic Algorithm (RP-1438) (SL-08-055)

Mounir Mossolly, Nesreen Ghaddar, Ph.D., Member, American University of Beirut, Beirut, Lebanon; Kamel Ghali, Beirut Arab University, Beirut, Lebanon; Lars Jensen, Member, Lund University, Lund, Sweden

This study is concerned with optimizing and comparing operational parameters for different control strategies of the combined chilled ceiling displacement ventilation (CC/DV) system subject to transient load using genetic algorithm while aiming to create the best indoor air quality (IAQ) and thermal comfort. The control strategies included: 1) varying chilled ceiling temperature (base strategy), 2) varying displacement ventilation supply conditions, and 3) varying both chilled ceiling temperature and supply air conditions (multiple control variables).

Development of Adaptive Algorithms for the Operation of Windows, Fans and Doors to Predict Thermal Comfort and Energy Use in Pakistani Buildings (SL-08-056)

Hom B. Rijal, Ph.D., Oxford Brookes University, Oxford, United Kingdom; Paul Tuohy, University of Strathclyde, Glasgow, United Kingdom; Michael A. Humphreys, J. Fergus Nicol, Oxford Brookes University, Oxford, United Kingdom;

Aizaz Samuel, Ph.D., University of Strathclyde, Glasgow, United Kingdom; Iftikhar A. Raja, Ph.D., COMSAT Institute of Information Technology, Abbottabad, Pakistan; Joe Clarke, Ph.D., University of Strathclyde, Glasgow, United Kingdom

This year-round field investigation of the use of building controls (windows, doors and fans) in 33 Pakistani offices and commercial buildings focuses on 1) how the occupants' behavior is related to thermal comfort, 2) how people modify the indoor environment and 3) how we can predict the occupants' behavior. We have found that the use of building controls depends on climate and season. The use of these controls has a cooling effect on the occupant through increasing the air movement or the ventilation. The behavioral model yields adaptive algorithms that can be applied in building thermal simulations to predict the effects of the occupants' behavior on energy-saving building design.

Human Thermal Model with Extremities for Asymmetric Environments (SL-08-057)

Anthony Iyoho, Tai Jang, Satish S. Nair, Ph.D., P.E., Member, University of Missouri-Columbia, Columbia, MO

A new computational model of the human thermal system that accounts for asymmetric environments and includes extremities is reported. The model incorporates radial and circumferential heat transfer along with arterial and venous countercurrent blood flow. Digits are modeled using arteriovenous anastomoses (AVAs) to provide finer prediction of toe and fingertip temperatures, all of which are important in evaluating extremity discomfort.

Modeling Individual Variations in Thermal Stress Response for Humans in Transient Environments (SL-08-058)

Tai S. Jang, Anthony E. Iyoho, Satish S. Nair, Member, University of Missouri-Columbia, Columbia, MO ; Larry G. Berglund, Ph.D., P.E., US Army Research Institute of Environmental Medicine, Natick, MA

The effect of individual differences on thermal stress response for semi-nude supine human subjects in transient environments is modeled using an experimental data set. Two transient climatic parameters and seven individual characteristics are used as inputs to predict three thermal responses using a novel transient computational model. The model is developed using a neural network after ensuring generalization and also checking with results reported in the literature for predictions. The results have applications for heat stress monitoring, and other biomedical applications.

Design Charts for Combined Chilled Ceiling Displacement Ventilation System (RP-1438) (SL-08-059)

Nesreen Ghaddar, Ph.D., Member, American University of Beirut, Beirut, Lebanon; Kamel Ghali, Ph.D., Beirut Arab University, Beirut, Lebanon; Ralph Saadeh, Student Member, Amer Keblawi, Student Member, American University of Beirut, Beirut, Lebanon

This paper proposes operational design charts for combined chilled ceiling (CC) displacement ventilation (DV) hybrid air conditioning system (CC/DV). The design charts were developed by performing a large number of simulations using a simplified transport plume multi-layer model of the CC/DV conditioned space. The simulation model results were validated by conducting a series of experiments that showed good agreement with the predictions of the simplified model of the stratification height, the CC. Two correlations were developed at high predictability for the stratification height and vertical temperature gradient dependence on room height and system operational parameters. load, and the room air vertical temperature gradient.

Potential R-114 Replacement Refrigerants (SL-08-060)

J. Steven Brown, Ph.D., P.E., Member, The Catholic University of America, Washington, DC

This paper uses the methodology for evaluating the thermodynamic performance potentials of alternative refrigerants described in, for example, Reid et al. (1987) and Poling et al. (2001)—and illustrated in recent publications by Brown (2007a, 2007b.)—to evaluate 56 potential R-114 replacement refrigerants for high-temperature heat pumping applications. An idealized vapor compression refrigeration cycle is used to estimate the performance potentials (Coefficient of Performance and Volumetric Heating Capacity) of the 56 refrigerants. In addition to the coefficient of performance and volumetric heating capacity, other basic cycle data are provided for each refrigerant. Furthermore, some other relevant data, i.e., global warming potential, flammability, and toxicity are provided.

Comparative Performance of Four Prototype Mechanical Systems in a Desert Climate (SL-08-061)

David A. Springer, Member, Willard L. Dakin, P.E., Member, Davis Energy Group, Davis, CA ; Mark Eastment, Associate Member, National Renewable Energy Laboratory, Golden, CO ; Leo I. Rainer, Davis Energy Group, Davis, ; Ed Hancock, Mountain Energy Partnership, Davis, CA

This paper reviews results of approximately fifteen months of monitoring of four houses located in the desert climate of Borrego Springs, California. Four houses were constructed using identical floor plans but differing wall materials, and different cooling systems that were designed to reduce energy use in this extreme hot climate. Cooling systems evaluated include a high SEER two-speed air conditioner, an evaporative condenser, two prototype two-stage evaporative coolers, and two floor cooling systems. Energy savings for the high performance systems was evaluated relative to a standard 13 SEER air conditioner, and the economic potential of these systems is reviewed. The paper also evaluates the performance of two unique floor cooling systems.

Analytical Formulas for Calculating Water Evaporation From Pools (SL-08-062)

M. Mohammed Shah, Ph.D., P.E., Fellow ASHRAE, Engineering Research Consultation, Redding, CT

Calculation of evaporation from pools of water such as swimming pools is needed for design and analysis. Numerous empirical equations have been proposed for evaporation from undisturbed pools to quiet air but have been found inaccurate. A formula derived using the analogy between heat and mass transfer was presented by the present author in 1981 and was further developed into the final form in publications between 1990 and 2002. However, the complete derivation of this formula has been unavailable as only parts of it were given in each of the earlier papers. The complete derivation is given here.

Design and Heat Transfer Analysis of a New Psychrometric Environmental Chamber for Heat Pump and Refrigeration Systems Testing

(SL-08-063)

Lorenzo Cremaschi, Ph.D., Associate Member, Edwin Lee, Student Member, Oklahoma State University, Stillwater, OK

This paper presents the design and heat transfer calculations of a new psychrometric environmental control climate chamber for heat pump and refrigeration systems testing. First, the standards for rating air conditioning and refrigeration systems are used to determine layout and floor area of the chamber. Then, a heat transfer model is developed to estimate the heat gain from the surrounding into the climate control chamber when the interior conditioned space is at temperature below freezing. The model, which was validated with data from the literature, also computes the wall thickness that would prevent water vapor condensation and subsequent accumulation on the outside walls of the facility.

WEDNESDAY, 6/25
8 A.M. – 9:30 A.M.

Wednesday, June 25, 8 a.m. – 9:30 a.m.

Transactions Session 13 (Basic)

Standard of Care for GSHP Design: Back to Basics

Track: Systems and Equipment

Room C

Sponsor: 6.8 Geothermal Energy Utilization

Chair: Lisa M. Meline, P.E., Member, Meline Engineering Corp., Sacramento, CA

For the design of ground source heat pumps there are several good design guidelines and tools available, including a recent update to the ASHRAE Handbook in 2007. The following three presentations provide the most current information on commercial open and closed loop heat pump system design and design issues as well as introduce a new method for assessing these systems during the planning phase of a project.

1. A Method for Geoexchange Suitability Assessment (SL-08-030)

Scott Schillereff, Ph.D., Jeff D. Quibell, Katherine S. Johnston, EBA Engineering Consultants Ltd., Kelowna, British Columbia, Canada; Aidan Kiernan, University of British Columbia, Kelowna, British Columbia, Canada

2. Design Issues in Commercial Open Loop Heat Pump Systems (SL-08-031)

Kevin Rafferty, P.E., Associate Member, Wapiti Engineering, Klamath Falls, OR

3. A 12-Step Method for Closed-Loop Ground Source Heat Pump Design (SL-08-032)
Steve Kavanaugh, Ph.D., Fellow ASHRAE, University of Alabama, Tuscaloosa, AL
Wednesday, June 25, 8 a.m. – 9:30 a.m.
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Seminar 55 (Intermediate)

Air and Contaminant Flow in the Personal Micro-Environment, Part 1

Track: Fundamentals
Room G

Sponsor: 4.10 Indoor Environmental Modeling

Chair: John Zhai, Ph.D., Member, University of Colorado, Boulder, CO

This seminar explores the recent advances in understanding the air and contaminant flow status in the personal micro-environment under different HVAC systems of different space types. Both experimental and modeling approaches and results are presented. The seminar helps identify appropriate and benchmark experimental and simulation methods and advance the knowledge of the influence of space layout and system designs on personal micro-environments. This will assist the design and development of more energy-efficient, comfortable and user-friendly indoor environments and systems.

1. Estimation of Air Quality in a Car by Means of Age and Residual Lifetime of Air with CFD and Experiment
Shinsuke Kato, Ph.D., Fellow ASHRAE, University of Tokyo, Tokyo, Japan
2. Experimental and CFD Modeling of Moving Body Effects on Contaminant Transport Inside Aircraft Cabins
Qingyan Chen, Ph.D., Fellow ASHRAE, Purdue University, West Lafayette, IN
3. Comparing the Effectiveness of Ceiling Diffusers in Reducing Medical Workers' Exposure to Aerosol Pathogens
Jianlei Niu, Ph.D., Member, The Hong Kong Polytechnic University, Hong Kong, China
4. Control of Wake-Induced Exposure Using an Interrupted Oscillating Jet
James Bennett, Ph.D., Member, National Institute of Occupational Health & Safety, Cincinnati, CA

Wednesday, June 25, 8 a.m. – 9:30 a.m.

Seminar 56 (Intermediate)



Benchmarking for Carbon Analysis: Here's What's Coming

Track: Benchmarking
Room I

Sponsor: 1.9 Electrical Systems

Chair: Russell Tiffany, Member, Johnson Controls Inc., York, PA

The papers, journals and airwaves are full of debate on carbon footprints and the effect on global warming. This seminar addresses three potential approaches to carbon footprint reduction. The first is to use the guidelines of LEED certification to improve overall energy consumption, the second looks at specific electric technologies and the third looks at using the carbon reductions to prioritize multiple projects.

1. Reducing Your Carbon Footprint with LEED Certification
Doug Gray, EMC Engineers, Inc., Alpharetta, GA
2. Carbon and Electric Uses: What You Should Know
Steven Rosenstock, P.E., Member, Edison Electric Institute, Washington, DC
3. Prioritization of Energy Efficiency Practices Based on Carbon Reduction
Katherine Hammack, Member, Ernst & Young LLP, Phoenix, AZ

Wednesday, June 25, 8 a.m. – 9:30 a.m.

Seminar 57 (Intermediate)

District Cooling in the Middle East: An Update from Different Industry Perspectives

Track: Applications
Room D

Sponsor: 6.2 District Energy; 6.1 Hydronic and Steam Equipment and Systems; TC 6.1 Sub-committee on central chilled water plants

Chair: Steve Tredinnick, P.E., Member, Syska Hennessy Group, Madison, WI

District cooling has blossomed in the Middle East, especially in the UAE where plant sizes over 100,000 tons are common. Growth numbers of exceeding 1,000,000 tons per year are projected for the next 4 to 6 years for the UAE alone, setting new benchmarks in design, manufacturing and construction. This seminar addresses how the design community, chiller manufacturers and contractors support this unprecedented growth and how the growth is affecting the infrastructure.

1. Benchmarking: The Rationale for District Cooling in the Middle East
Jay Eldgridge, Member, McQuay International, Minneapolis, MN
2. Challenges and Opportunities for Cooling System Design in the Middle East
Ian Spanswick, Member, Johnson Controls/York International, York, PA
3. The EPC Contractor's Point of View
Trevor Richter, Member, The Stellar Group, Jacksonville, FL

Seminar 58 (Basic)

Exergy 101

Track: Fundamentals

Room B

Sponsor: TG1 Exergy Analysis for Sustainable Buildings (EXER)

Chair: Birol Kilkis, Ph.D., Fellow ASHRAE, Watts Radiant, Springfield, MO

This seminar deals with the fundamentals and essential concepts of exergy and comparison of energetic and exergetic aspects of thermal equipment and buildings. The presentations include several examples focusing on various daily, practical examples for those who want to understand the true role of exergy for a sustainable built environment and its metrication.

1. Exergy vs Energy

Ibrahim Dincer, Ph.D., Member, UOIT, Oshawa, Ontario, Canada

2. How to Conduct An Exergy Analysis

Ibrahim Dincer, Ph.D., Member, UOIT, Oshawa, Ontario, Canada

3. How to Benchmark Low-Exergy Buildings

Dietrich Schmidt, Ph.D., Member, Fraunhofer-Institute for Building Physics, Kassel, Germany

4. Exergy Efficiency Definitions and Their Use

Ibrahim Dincer, Ph.D., Member, UOIT, Oshawa, Ontario, Canada

Wednesday, June 25, 8 a.m. – 9:30 a.m.

Seminar 59 (Intermediate)

Greening Refrigeration, Part 1: Commercial

Track: Refrigeration

Room E

Sponsor: Refrigeration Committee; 10.7 Commercial Food and Beverage Cooling Display and Storage

Chair: Cynthia Gage, Ph.D., Fellow ASHRAE, U.S. EPA, Research Triangle Park, NC

Refrigeration is one of the most energy intensive end-uses within the commercial sector wherein the refrigeration equipment is used for merchandising and preserving food at appropriate temperature levels to ensure food safety. The three major technologies used are stand-alone equipment, condensing units and centralized systems. Greening the equipment and their systems involves the adoption of technologies, strategies, and practices that reduce refrigerant emissions and increase the refrigeration systems' energy efficiency. This seminar presents recent studies and activities to help the commercial refrigeration sector understand and evaluate its "green" options.

1. Supermarkets Go Green: The U.S. EPA's GreenChill Partnership

David Godwin, P.E., Member, U.S. EPA, Washington, DC

2. Analysis of Alternative Supermarket Refrigeration Technologies

Georgi Kazachki, Ph.D., Fellow ASHRAE, Cryotherm, Atlanta, GA

3. Reducing the Environmental Impacts of Commercial Refrigeration Systems

Denis Clodic, Dr.Eng., Member, Armines, Paris, France

4. Secondary Refrigeration using CO₂: Performance and Lessons Learned in a Large Retail Food Store

Keith Smith, Member, VaCom Technologies, La Verne, CA

Wednesday, June 25, 8 a.m. – 9:30 a.m.

Seminar 60 (Intermediate)



Introduction to Advanced Energy Design Guide, K-12 School Buildings

Track: Applications

Room A

Sponsor: 9.7 Educational Facilities

Chair: Melvin G. Glass, P.E., Member, EMC Engineers, El Paso, TX

This seminar introduces ASHRAE members to the newly published Advanced Energy Design Guide, K-12 School Buildings. Presentations include an historical overview, look at manual structure and an introduction to and application of the AEDG manual in the work place.

1. Introduction and Overview on the Advanced Energy Design Guide for K-12 Educational Facilities

Paul Torcellini, Ph.D., Member, National Renewable Energy Laboratory, Golden, CO

2. Best Practices for Maximizing Energy Performance: HVAC Applications

John A. Murphy, Member, Trane Company, LaCrosse, WI

3. Best Practices for Maximizing Energy Performance: Building Envelope

Merle McBride, Ph.D., P.E., Member, Owens Corning, Inc., Granville, OH

4. Documentation and Modeling of 30% Energy Reduction

Wednesday, June 25, 8 a.m. – 9:30 a.m.

Seminar 61 (Basic)

New Rules and Tools for Benchmarking California's Commercial Buildings

Track: Benchmarking
Room F

Sponsor: 7.6 Systems Energy Utilization

Chair: Martha Brook, California Energy Commission, Sacramento, CA

There is a new law in California that will require an energy benchmark at the time of a commercial building's lease, lend or sale. An energy benchmark will also be required before a building owner can apply for a financial incentive to install a renewable energy system. These new "rules" have escalated research on the impacts of different energy performance rating methods and the development of benchmarking tools. This seminar summarizes these nascent benchmarking policies and presents the results of research that will shape California's energy performance future.

1. The Challenges and Opportunities Created by California's New Benchmarking Legislation

Martha Brook, P.E., Member, California Energy Commission, Sacramento, CA

2. Energy Savings Potential Estimates Using CBECS and CEUS

Michael MacDonald, Member, Oakridge National Laboratory, Oak Ridge, TN

3. EnergyIQ: An Action Oriented Benchmarking Tool to Identify and Prioritize Efficiency Opportunities in Commercial Buildings

Paul Mathew, Ph.D., Member, Lawrence Berkeley National Laboratory, Berkeley, CA

WEDNESDAY, 6/25
9:45 A.M. – 10:45 A.M.

Wednesday, June 25, 9:45 a.m. – 10:45 a.m.

Seminar 62 (Intermediate)

Benchmarking Central Chilled Water Plant Efficiency Using Recently Published Guideline 22

Track: Operational Topics
Room C

Chair: Dennis J. Wessel, P.E., Fellow ASHRAE, Debra-Kuempel, Cincinnati, OH

Recently published Guideline 22 defines the requirements for the provision and installation of instrumentation for the determination of chiller plant efficiencies. This seminar discusses this instrumentation and how it will assist owners and operators in the maximization of chiller plant and component efficiencies.

1. The Value of Benchmarking Chilled Water Plant Efficiency in Commercial Properties

John L. Kuempel, Member, Karpinski Engineering, Cleveland, OH

2. An Owners Perspective on Utilization of Guideline 22 for the Optimization of Chiller Plant Energy Use

John I. Vucci, Member, University of Maryland, College Park, MD

Wednesday, June 25, 9:45 a.m. – 10:45 a.m.

Seminar 63 (Intermediate)

Greening Refrigeration, Part 2: Industrial

Track: Refrigeration
Room E

Sponsor: Refrigeration Committee; 10.1 Custom Engineered Refrigeration Systems

Chair: Douglas Reindl, Ph.D., P.E., Member, IRC-University of Wisconsin-Madison, Madison, WI

Industrial refrigeration systems generally are characterized as custom-engineered systems and, because of their large size, field-erected. They find use in food production, chemical processing, and other industrial processes. There is an increasing trend among refrigeration end-users to seek out systems and strategies to make their refrigeration infrastructure "green". This seminar explores current trends in making industrial refrigeration systems sustainable.

1. Moving to Green Refrigerants in Low Temperature Industrial Refrigeration Applications

Donald Cleland, Ph.D., Member, Massey University, Palmerston North, New Zealand

2. Industrial Refrigeration: What Does "Green" Look Like?

Todd B. Jekel, Ph.D., P.E., Member, IRC-University of Wisconsin-Madison, Madison, WI

Seminar 64 (Basic)

Retrocommissioning a Geothermal High School

Track: Sustainability

Room I

Sponsor: 6.8 Geothermal Energy Utilization; 6.8 Geothermal Energy Utilization

Chair: J. B. Singh, Member, J and P Engineers, P.A., Linwood, NJ

A new, geothermally heated and cooled high school was constructed in suburban Philadelphia, Pennsylvania in 2003. It consists of 121 classrooms, an indoor pool, an auditorium, a gymnasium, and a cafeteria. After two years' operating experience it was determined that the HVAC system's operating cost was well above budget and expectation. An ESCO was formed, and a team of engineers and contractors implemented a total of 13 corrective energy conservation measures. The results are presented from economic and engineering perspectives.

1. Engineering Considerations in the Retrocommissioning Process

Arthur W. Hunt, Member, J and P Engineers, P.A., Ambler, PA

2. Financial Issues, Opportunities, and Results of the Retrocommissioning Process

Raymond G. Berkebile, Member, Enerwise Global Technologies, Kennett Square, PA

Wednesday, June 25, 9:45 a.m. – 10:45 a.m.

Seminar 65 (Intermediate)

Retrofit of Commercial Buildings to Reduce Air Leakage

Track: Fundamentals

Room F

Sponsor: 4.3 Ventilation Requirements and Infiltration

Chair: Steven Emmerich, Member, National Institute of Standards and Technology, Gaithersburg, MD

Despite common assumptions that envelope air leakage is not significant in office and other commercial buildings, published measurements have shown that these buildings are fairly leaky. Infiltration in commercial buildings can have many negative consequences, including reduced thermal comfort, interference with the proper operation of mechanical ventilation systems, degraded indoor air quality (IAQ), moisture damage of building envelope components and increased energy consumption. However, building performance can be significantly improved by retrofitting commercial building envelopes to reduce air leakage. This seminar provides a fundamental overview of airtightness testing of commercial buildings and presents case studies in retrofit of commercial building envelopes.

1. Airtightness Testing of Commercial Buildings

David Saum, Member, Infiltec, Falls Church, VA

2. Case Studies in Retrofit of Commercial Building Envelopes

Tony Woods, Canam Building Envelope Specialists Inc, Mississauga, Ontario, Canada

Wednesday, June 25, 9:45 a.m. – 10:45 a.m.

Seminar 66 (Advanced)

Use of Equation Solvers for Simulation

Track: Applications

Room G

Sponsor: 4.7 Energy Calculations

Chair: Michael Wetter, Ph.D., Member, LBNL, Berkeley, CA,

This seminar shows how modeling and simulation environments that are built using equation-based solvers can benefit the building energy community. Such modeling and simulation environments separate the formulation of a model's underlying physics from its numerical solution algorithms. This allows input-output free modeling, it leads to faster model development time and it facilitates model reuse for different applications. Equation-based modeling and simulation environments are frequently used in various industrial sectors. For building energy simulation, however, they have not yet enjoyed wide-spread use. This seminar encourages discussions to understand their applicability, advantages and limitations for the building energy community.

1. Development of a Simplified Building HVAC System Model with the Help of an Equation Solver

Stéphane Bertagnolio, Student Member, Vincent Lemort, Student Member, Jean Lebrun, Ph.D., Fellow ASHRAE, University of Liège, Liège, Belgium

2. Developments and Applications of Equation Based Modeling in Support of System Innovation and Controls Design

Michael Wetter, Ph.D., Member, LBNL, Berkeley, CA

Wednesday, June 25, 9:45 a.m. – 10:45 a.m.

Forum 15 (Intermediate)

Bioaerosols, Particulates and Ultrafines in Dental Operator

Track: Applications

Room B

Sponsor: 9.6 Healthcare Facilities

Chair: Pui L. Fan, Ph.D., Member, American Dental Association, Arlington Heights, IL

This forum presents results of measurements of bioaerosols, particulates and ultrafine particulates generated in simulated dental procedures in a one-chair dental operator.

Wednesday, June 25, 9:45 a.m. – 10:45 a.m.

Forum 16 (Intermediate)

Defining Benchmarking for Exergy

Track: Benchmarking

Room D

Sponsor: TG1 Exergy Analysis for Sustainable Buildings (EXER)

Chair: Krishnan Gowri, Ph.D., Member, Battelle NW, Richland, WA

This forum discusses the ways and means of developing benchmarking rules and methodologies for sustainability rating of buildings with respect to the second law of thermodynamics. Exergy rationale is gaining more importance due to recent trends of global warming and concerns about carbon emissions from the built environment and especially the buildings. Therefore exergy based analyses and rating methodologies must have robust benchmarking markers. This forum is the first to discuss such important matters in the building industry.

Wednesday, June 25, 9:45 a.m. – 10:45 a.m.

Forum 17 (Basic)

Hot Topics: SPC 145.2 Method of Testing Full-scale Gaseous Contaminant Filters

Track: Systems and Equipment

Room A

Sponsor: 2.3 Gaseous Air Contaminants and Gas Contaminant Removal Equipment

Chair: Kathleen Owen, Member, RTI International, Research Triangle Park, NC

ASHRAE SPC 145.2 is developing a method of testing full-scale gaseous contaminant filters and air cleaning devices in the laboratory. The objectives and capability of the draft test method are outlined and comments sought regarding the needs of potential users of the data.

WEDNESDAY, 6/25
11 A.M. – 12:30 P.M.

Wednesday, June 25, 11 a.m. – 12:30 p.m.

Seminar 67 (Intermediate)

Actual Building Energy Performance: Measurement, Benchmarking and Labeling

Track: Benchmarking

Room F

Sponsor: 1.5 Computer Applications

Chair: Robert Hitchcock, Ph.D., Member, Lawrence Berkeley National Laboratory, Berkeley, CA

Considerable attention has been, and continues to be given to the challenge of designing energy efficient buildings. To date, less attention has been given to formally assessing the actual energy performance of existing buildings. How well do existing buildings, especially those designed to be high performance, really perform compared to design predictions? How can you informatively measure actual building performance? How does your building's performance compare with other similar buildings? How can improving actual energy performance be promoted? This seminar looks at emerging energy performance measurement, benchmarking, and labeling approaches for existing buildings that address these questions and more.

1. ASHRAE/CIBSE/USGBC Performance Measurement Protocols for Commercial Buildings

Jeff S. Haberl, Ph.D., P.E., Member, Texas A&M University, College Station, TX

2. Benchmarking 120 LEED Building Energy Bills for Comparison to CBECS and Energy Star

Mark Frankel, New Buildings Institute, Portland, OR

3. Initial Experience with the UK Scheme for Building Energy Labeling

Hywel Davies, Ph.D., Member, CIBSE, London, United Kingdom

Wednesday, June 25, 11 a.m. – 12:30 p.m.

Seminar 68 (Intermediate)

Air and Contaminant Flow in the Personal Micro-Environment, Part 2

Track: Fundamentals

Room G

Sponsor: 4.10 Indoor Environmental Modeling

Chair: John Zhai, Ph.D., Member, CU-Boulder, Boulder, CO

This seminar explores the recent advances in understanding the air and contaminant flow status in the personal micro-environment under different HVAC systems of different space types. Both experimental and modeling approaches and results are presented. The seminar helps identify appropriate and benchmark experimental and simulation methods and advance the knowledge of the influence of space layout and system designs on personal micro-environments. This will assist the design and development of more energy-efficient, comfortable and user-friendly indoor environments and systems.

1. Personalized Air Supplied Direct to the Boundary Layer of a Seated Person

Peter Nielsen, Ph.D., Fellow ASHRAE, Aalborg University, Aalborg, Denmark

2. Computation of Cross Coupling of Personal Micro-Environments in Adjacent Cubicles

Ezzat Khalifa, Ph.D., Member, Syracuse University, Syracuse, NY

3. Interaction of Personalized Flow and Free Convection Flow Around Human Body at the Vicinity of the Breathing Zone

Arsen Melikov, Ph.D., Member, Technical University of Denmark, Lyngby, Denmark

4. On the Requirements for Accurate CFD Simulations of the Personal Micro-Environment

Thong Dang, Ph.D., Member, Syracuse University, Syracuse, NY

Wednesday, June 25, 11 a.m. – 12:30 p.m.

Seminar 69 (Intermediate)



Benchmarking: New Environmental and Economic Metrics for Evaluating TES

Track: Benchmarking

Room B

Sponsor: 6.9 Thermal Storage

Chair: Alan Green, P.E., Member, CBI, Plainfield, IL

Thermal Energy Storage (TES) has become an established technology based on capital cost savings and energy cost savings from both energy conservation and reduction of utility demand charges. While all of those factors will continue to apply, it is becoming more necessary to also evaluate TES in comparison with other sustainable green building technologies. TES can help reduce the carbon footprint of a building or group of buildings. This seminar provides new data on measuring the impact of TES on global warming emissions and other metrics.

1. High Performance Green Buildings with TES

Mark MacCracken, Member, Calmac, Fair Lawn, NJ

2. Case Study of New PPL Plaza

Steve Benz, Member, BAC, Baltimore, MD

3. Time-of-Day Impact on Average Emissions

John Nix, Member, FP&L, Miami, FL

Wednesday, June 25, 11 a.m. – 12:30 p.m.

Seminar 70 (Advanced)

Indirect and Direct Evaporative Cooling at Altitude with Attitude

Track: Applications

Room A

Sponsor: 5.7 Evaporative Cooling

Chair: Leon E. Shapiro, J.D., Member, VRTX Technologies, Las Vegas, NV

Evaporative cooling, both direct and indirect, have proven to be highly effective in providing energy efficient cooling. This seminar explores the affect that higher altitudes have on the efficiency of evaporative cooling systems, and provides guidance on the design of systems that minimize (or even eliminate) the need for mechanical cooling.

1. Calculations for Sizing Evaporative Coolers/Humidifiers at Higher Elevation

Patricia Graef, P.E., Fellow ASHRAE, Munters Corporation, Fort Myers, FL

2. Indirect/Direct Evaporative Cooling and Underfloor Air Combine to Save Tax Dollars

Tom Colvin, P.E., Member, Colvin Engineering Associates, Inc., Salt Lake City, UT
3. A Non-Conventional Approach to Natatorium Air Management: How a System That Air Conditions the Exhaust and Humidifies the Supply Delivers Top Results in Dry Climates

Keith Dunnavant, Member, Munters/Des Champs Technologies, Buena Vista, VA

Wednesday, June 25, 11 a.m. – 12:30 p.m.

Seminar 71 (Intermediate)

Seismic Issues for Sustainability

Track: Applications

Room C

Sponsor: 2.7 Seismic and Wind Restraint Design

Chair: Edward Douglas Fitts, P.E., Member, Fitts HVAC Consulting, LLC, Edwardsville, IL

This seminar discusses the do's and don'ts of seismic design and installation, and how and why mechanical equipment qualifications are necessary for engineering a project for seismic events.

1. Seismic Restraint Design Do's and Don'ts for HVAC Systems

Scott D. Campbell, Ph.D., P.E., Member, Structural Analysis Consulting Group/ Kinetics Noise Control, Louisville, KY

2. Seismic Restraint Installation Do's and Don'ts for HVAC Systems

Robert E. Simmons, P.E., Member, Amber Booth/ A VMC Co., Houston, TX

3. Seismic Equipment Qualification

James A. Carlson, P.E., Member, Omaha Public Power District, Springfield, NE

Wednesday, June 25, 11 a.m. – 12:30 p.m.

Seminar 72 (Intermediate)

Small Duct, High Velocity Systems: How and When to Use It

Track: Systems and Equipment

Room I

Sponsor: 8.11 Unitary and Room Air Conditioners and Heat Pumps

Chair: Ramez Afify, P.E., Member, Clifford Dias, P.E., P.C., New York, NY

This session addresses the theory and application of small diameter high velocity systems (SDHV). It discusses the system advantages and disadvantages, when to use the system, and how to design it.

1. The Hows and Whys of Hi-Velocity: An Introduction to the Operation and Applications of Small Diameter High Velocity (SDHV)

Leon Prevost, Member, Hi-Velocity, Edmonton, Alberta, Canada

2. Energy Performance and Thermal Comfort Assessment of a Small Duct, High Velocity Distribution System

Edward A. Vineyard, Member, Oak Ridge National Laboratory, Oak Ridge, TN

3. SDHV: What Is It and Why Should I Care?

Henry DeLima, Member, DeLima Associates, McLean, VA

4. Designing Small-Duct, High-Velocity Systems

Craig S. Messmer, P.E., Member, Unico Inc., Saint Louis, MO

Wednesday, June 25, 11 a.m. – 12:30 p.m.

Seminar 73 (Intermediate)

Striving for a LEED Certified Refrigerated Warehouse

Track: Refrigeration

Room D

Sponsor: 10.5 Refrigerated Distribution and Storage Facilities

Chair: Daniel Dettmers, Member, IRC, U.W. Madison, Madison, WI

The LEED rating system has been developed to encourage and accelerate global adoption of sustainable green building and development practices through the creation and implementation of universally understood and accepted tools and performance criteria. But so far, a LEED rating has been difficult to obtain for a refrigerated facility since each facility is unique in its construction and energy use. This session examines efforts in the industry to move toward an energy code and a LEED certification for a refrigerated warehouse. The session offers information on available benchmark data, California's proposed refrigerated warehouse energy code and attempts to obtain LEED certification of a refrigerated warehouse.

1. Current Benchmark Information Available for Refrigerated Warehouses

Douglas Reindl, Ph.D., P.E., Member, IRC, U.W. Madison, Madison, WI

2. California's Title 24 Building Code Requirements for Refrigerated Warehouses: CA LEED Baseline?

Jon McHugh, P.E., Associate Member, Hescong Mahone Group, Inc., Fair Oaks, CA

3. Obtaining LEED Certification for a Refrigerated Warehouse

Bryan Dobbs, Associate Member, VaCom, San Luis Obispo, CA

Seminar 74 (Intermediate)

Turbine Inlet Cooling (TIC) Applications in Combined Heat and Power (CHP) Systems

Track: Applications

Room E

Sponsor: 1.10 Cogeneration Systems

Chair: Dharam V. Punwani, Member, Avalon Consulting, Inc., Naperville, IL

CHP systems often utilize combustion turbines (CTs) as the generating source of electric power and recovered useful thermal energy. However, CTs have the inherent characteristic of dramatically reduced power outputs at elevated entering air temperatures. Yet periods of high ambient air temperatures generally coincide with periods of maximum demands for power and maximum power values. Cooling the inlet air to the CTs, restores the higher power outputs. This seminar presents an overview of and insights into the use of Turbine Inlet Cooling (TIC) in CHP applications, including a summary of many TIC-CHP installations covering a wide variety of sizes, localities and climates, as well as two Case Studies of TIC-CHP applications.

1. Overview of TIC in CHP Applications

John S. Andrepont, Member, The Cool Solutions Company, Chicago, IL

2. Case Study of TIC in a CHP Application

Donald P. Fiorino, P.E., ASHRAE Fellow, TAS, Ltd., Houston, TX

3. A Combined Gas Turbine/Absorption Refrigeration System for Power, Refrigeration and Water

S.A. Sherif, Ph.D., ASHRAE Fellow, University of Florida, Gainesville, FL